SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyrighted, 1888, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LIX.—No. 11. ESTABLISHED 1845. NEW YORK, SEPTEMBER 15, 1888. $3.00 A YEAR. WEEKLY.

INSTANTANEOUS PHOTOGRAPHY.

The perfection in the manufacture of gelatino-bromide sensitive compounds is now so complete that photographs are readily made instantaneously with far less trouble than was required in the days of the daguerreotype or of the more recent wet plate process, and this has led, as one would naturally expect, to the invention of special devices for more effectively utilizing the advantages obtained in the use of highly sensitive compounds.

One of the latest ideas based upon the dry process is the production of an extremely simple apparatus, so arranged that it cannot get out of order and adapted for use by the veriest "greenhorn," if we may so speak, or by one who knows nothing at all about photography. All that is required is to point the instrument at the object, press a button gently with finger, and the picture is made.

Another idea is that when a hundred exposures have been made, all the individual has to do is to send the apparatus to the manufacturers, who do all the work of finishing up the pictures. Thus no manipulation whatever is required by the purchaser, save the making of the exposures; the balance is done by persons especially skilled in the art, resulting, as might be expected, in the production of very uniform and satisfactory work. We believe this system has never been before placed on such an extensive commercial scale as is now commenced, and it promises to make the practice of photography well nigh universal.

The absence of removable bulky plate holders, of the drawing out of slides, of any danger from light streaks, will strike those acquainted with the old style of apparatus as being especially desirable, while the fact that one has a large roll of sensitive material to draw from in making the pictures inspires confidence and freedom, since the exposures may be made rapidly, without previous preparation and apparently without limit.

The novel apparatus shown in our engravings is designed to hold enough sensitive paper to produce one hundred pictures about 2⅝ inches in diameter, yet so compact that it measures but 6½ inches long, 3¼ inches wide, and 3¾ inches high, and weighs less than two pounds. The large engraving represents the actual size of the camera.

The "Kodak," for such is the name given to it by the manufacturers, is essentially a portable camera, intended mainly for making instantaneous exposures, but may be used for time work also when a secure place can be found to rest it upon. Its simplicity and lightness are its chief features. It consists of an outer rectangular case, neatly covered with black leather, having the rear end closed with a sliding box (see Fig. 2) holding the sensitive paper on a spool, from which,

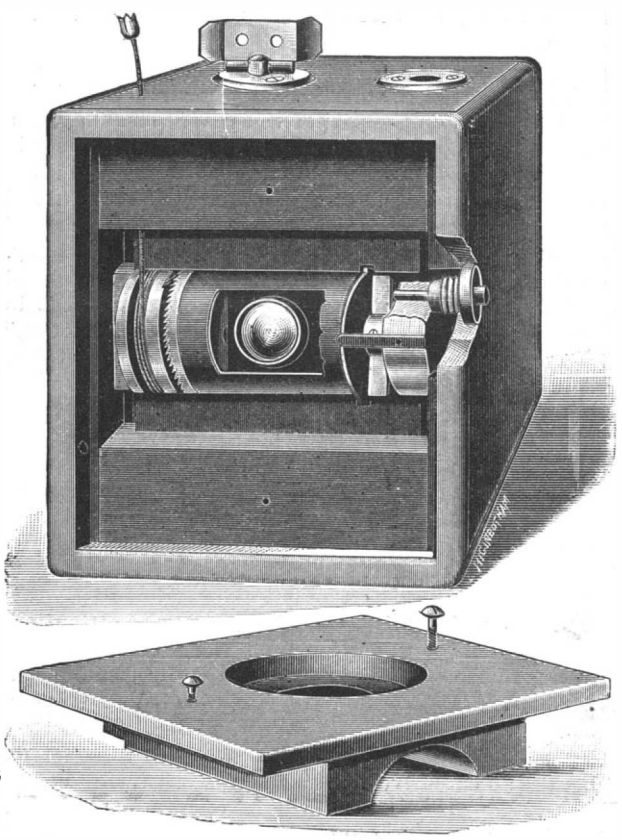


Fig. 1.—THE KODAK CAMERA SHUTTER.

in unwinding, it passes over an index roll, having an indicator mark in the direction of its diameter on the upper end of its axis, and also metal points on its circumference for puncturing the division line between the pictures. From the supply spool the paper passes over a small measuring roll, thence behind the metal mask having a circular opening, and in front of the exposing platform, and is finally wound up on the spool to which the key is attached.

As the light can only impinge on the paper within the circular opening, a circular negative is obtained. When the box of sensitive material is slid home into the rear of the camera case, it is prevented from slipping out by the shank of the winding key, passing through the opening in the case, and screwing into the end or axis of the winding spool. It will be observed that all the parts of the supply box are very simple, easily operated, and readily taken apart.

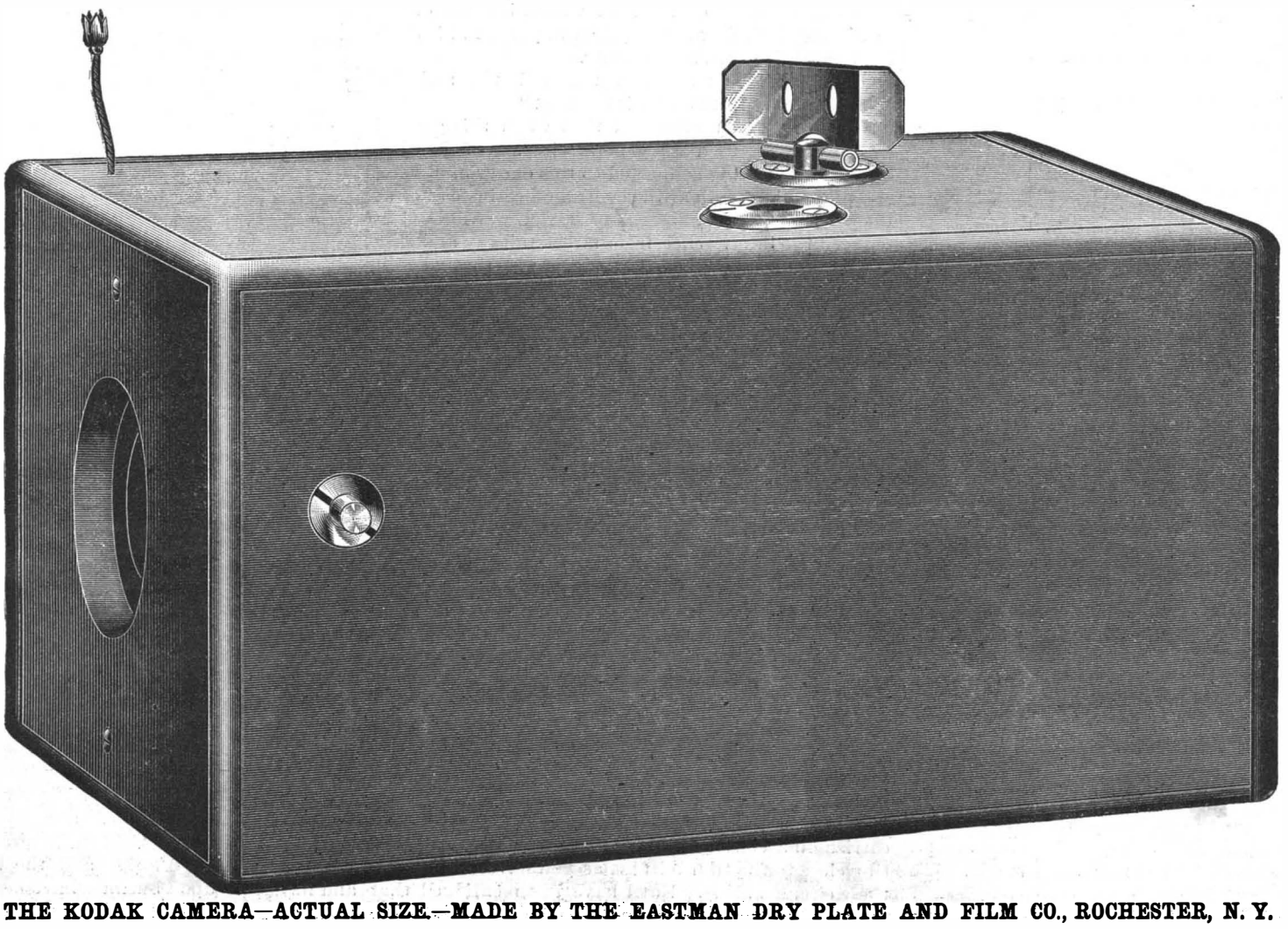
In the front portion of the camera is the shutter and lens, both very unique in their construction. (See Fig. 1, in which the front end protecting the shutter is removed and is shown just below the box. When in place, it clamps the shutter mechanism and is simply fastened by two screws.)

The shutter is cylindrical, having two apertures diametrically opposite each other, and rotates around the two ends of the lens continuously in one direction. In the engraving (Fig. 1) the rectangular aperture of the shutter with the bright disk of the lens in the center is plainly seen. The shutter is propelled by a coiled flat spiral spring located in one end of it, which is wound up by an adjacent ratchet disk wheel, this being in turn operated through miniature pawls by a winding barrel. The latter is rotated by pulling up on the cord which is seen passing through the outer case of the camera in Fig. 1 and in the large engraving. A spring in the winding barrel rotates it in the opposite direction from the pull of the cord, and winds the latter up when released. Two or three short successive pulls on the cord are necessary to wind up the shutter spring to its full tension.

A very ingenious, simple, and positive escapement device is provided in connection with the release button, or pin, for setting off and holding the shutter. The latter will revolve continuously in one direction, stopping at each pressure of the release pin, for at least four or five times, before the shutter spring is completely unwound. The shutter, as will be seen, is very compact, and yet so complete that it cannot get out of order.

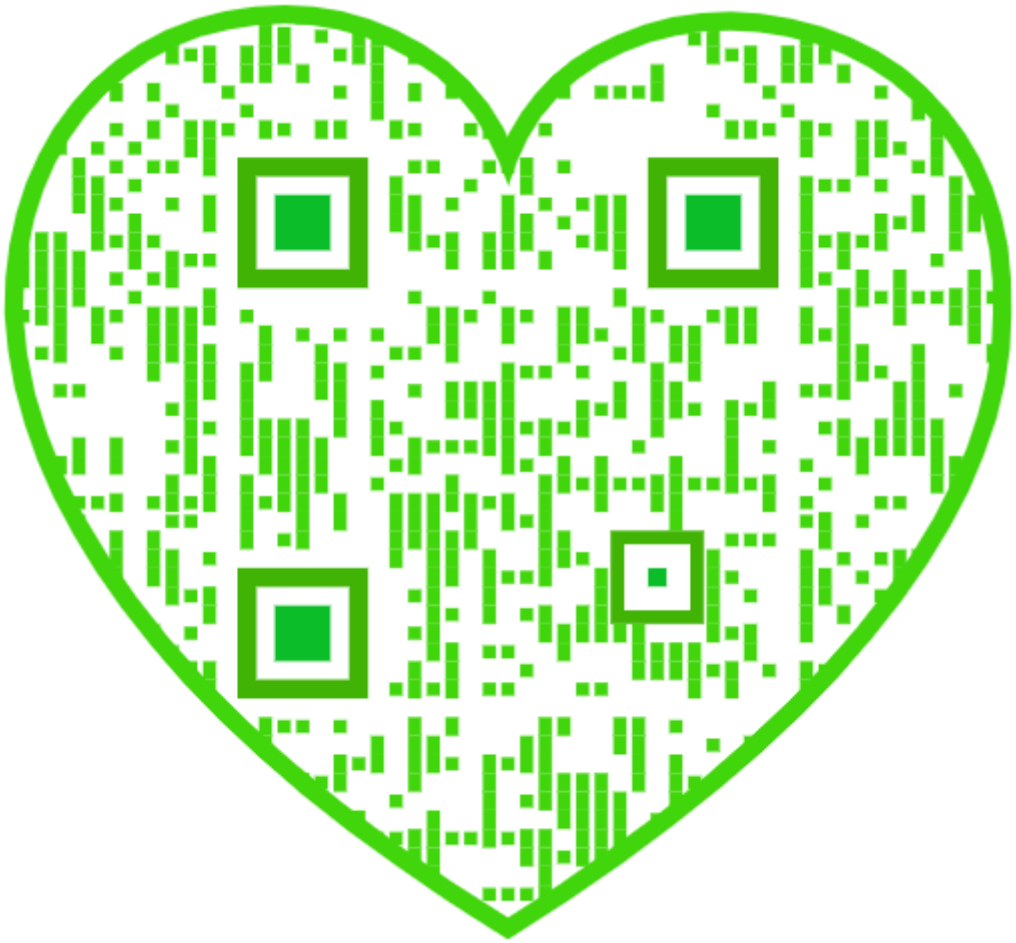
The manufacturers state that the lens is of the rapid rectilinear type. It is mounted in a thin metal tube, having a fine screw thread on its exterior. This is held rigidly in the axis of the shutter, and may be

(*Continued on page* 164.)



THE KODAK CAMERA—ACTUAL SIZE.—MADE BY THE EASTMAN DRY PLATE AND FILM CO., ROCHESTER, N. Y.

© 1888 SCIENTIFIC AMERICAN, INC.



Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S. or Canada..... .....$3 00
One copy, six months, for the U. S. or Canada..... ..... 1 50
One copy, one year, to any foreign country belonging to Postal Union, 4 00
Remit by postal or express money order.

Australia and New Zealand.—Those who desire to receive the SCIENTIFIC AMERICAN, for a little over one year, may remit £1 in current Colonial bank notes. Address

MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for U. S. and Canada. $6.00 a year to foreign countries belonging to the Postal Union. Single copies, 10 cents. Sold by all newsdealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to any address in U. S. or Canada, on receipt of *seven dollars*.

The safest way to remit is by draft, postal order, express money order, or registered letter.

Australia and New Zealand.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for a little over one year on receipt of £2 current Colonial bank notes.

Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

NEW YORK, SATURDAY, SEPTEMBER 15, 1888.

Contents.

(Illustrated articles are marked with an asterisk.)

Business and personal..... 170
Camera, "Kodak"*..... ... 159
Clock, large..... 165
Coppered carbons..... 169
Correspondence..... 165
Creosoting of wharf piles..... 169
Curtain, vehicle, improved*..... 164
Electrical street railways..... 166
Emery wheel, dangers of..... 166
Feathered artists..... 165
Feed trough for stock, improved*163
Ferdinand de Lesseps* 162
Fires caused by kerosene..... 164
Fires, self-extinguishment of... 164
Fortifications of the future..... 161
Gas, new and remarkable..... 161
Gleanings from various sources. 168
Hemlock lumber and bark..... 169
Hot weather in India..... ... 162
Hydrochinon 168
Ingot manipulator, improved*.... 166
Inoculating an elephant*..... 169
Invention and discovery..... 166
Inventions, agricultural..... 170
Inventions, engineering..... 170
Inventions, index of..... 171
Inventions, miscellaneous..... 170
Locomotive, noiseless, smokeless 163
Locomotive water scoop..... ... 160
Machinery of the Inman liner City of New York*..... 167
Mahogany the best finishing wood..... 165
Notes and queries..... 170
Onions, adhesive qualities of.... 165
Palace cars for hens..... ... 163
Paper, manufacture of, suggested improvement in..... ... 161
Philip Henry Gosse 160
Phonograph, Edison's in England 165
Photo bust*..... 166
Photographic portraits, new type of*..... 166
Photography, instantaneous*159, 164
Radiators, steam, regulator for* 162
Rocket, steam 165
Sleeper, what is a..... 164
Spectrum of "R" Cygnis..... 169
Spider, trap door..... 163
Telephone convention notes..... 160
Telephone convention, the..... 161
Toothpicks, wooden..... 168
Vehicle spindle, improved*..... 163
Yellow fever, continuance of.... 160

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 663.

For the Week Ending September 15, 1888.

Price 10 cents. For sale by all newsdealers.

PAGE

I. BIOLOGY.—The Micro-organisms of Air and Water.—By PERCY F. FRANKLAND.—An exhaustive and popular treatment of this subject, with details of methods and results.—3 illustrations..... 10587

II. BOTANY.—Flowering Trees and Shrubs.—Philadelphia or mock oranges and their availability in landscape gardening..... 10587

III. CHEMISTRY.—Maize or Corn Oil.—The manufacture, properties, uses and analysis of this product..... 10590
Some Phases in the Progress of Chemistry.—An abstract of Prof. C. E. MUNROE'S address before the A. A. A. S. at their Cleveland (1888) meeting..... 10590
The Chemical Constitution of Pearls.—By GEORGE HARLEY, M.D., F.R.S., and HARALD S. HARLEY.—Examination of oyster and cocoanut pearls; interesting statement of their properties, analysis and other points..... 10589

IV. CIVIL ENGINEERING.—The Tancarville Canal.—A canal between Harve and the Seine, now in process of construction. Notes of other improvements of the port.—2 illustrations..... 10592

V. ELECTRICITY.—On a Constant Daniell Cell, for Use as a Standard of Electromotive Force.—By COSMO I. BURTON, B.S.C., F.C.S.—A new Daniell battery in which diffusion of the solutions is completely avoided.—1 illustration..... 10598

VI. GEOGRAPHY.—The Census Maps of the United States.—The conic and polyconic projections of the United States—a suggestion in geography for the census..... 10591

VII. MECHANICAL ENGINEERING.—Emery Grinding Machinery.—Automatic surfacing and wheel tooth cleaning machine, using emery wheels as the cutting or abrading agents.—2 illustrations.. 10597
Pumping Solvents into Boilers.—An effective apparatus for the introduction of scale preventives and solvents into steam boilers.—1 illustration..... 10597
The Sun Motor.—By Capt. JOHN ERICSSON.—The distinguished inventor's last improvement—a parabolic reflector for concentrating the sun's rays.—2 illustrations..... 10592

VIII. METALLURGY.—Sodium and Aluminum.—The Castner process now in operation at Oldbury, England, with a description of the practical working of the process 10595
Steel at the Glasgow International Exhibition.—A graphic description of the remarkable exhibits shown at Glasgow..... 10594

IX. NAVAL ENGINEERING.—Automatic Marine Fog Signaling.—By Captain H. BERKELEY, R.N.—Fog signaling machinery of the type invented by Captain Barker, which automatically gives a distinctive signal for each course of the vessel.—3 illustrations 10596

X. ORDNANCE.—The Bofors Cast Steel Gun.—By Captain O. E. MICHAELIS, Ph.D., United States Army.—The production of guns from unforged open hearth steel by casting process.—Their excellent qualities and freedom from blowholes.—A plea for cast steel ordnance..... 10593

XI. PHYSICAL GEOGRAPHY.—The Great Japanese Volcanic Eruption.—A recent catastrophe in Japan, with its fearful results 10586
The Great Muir Glacier in Alaska.—A description of this immense glacier, far surpassing in size the Swiss glaciers..... 10586
Yellowstone Park.—The geysers, hot springs, and other wonderful features of the park described and illustrated.—11 illustrations 10583

XII. TECHNOLOGY.—Improved Power Loom.—An effort at simplification of the power loom—an improvement applicable to already existing machines.—1 illustration..... 10596

TELEPHONE CONVENTION NOTES.

Many men, ingenious and enterprising, with every incentive for study and investigation, are constantly at work perfecting the telephone service, and when they meet to compare a twelvemonth's notes, as they did last week [see another page], the progress made is clearly perceptible. The aim is, of course, to cheapen processes for the projector's benefit as well as to improve them in the interest of the subscriber, and so, though the user may get a deal of comfort in the promises held out last week of improved service, not a word was said to lead to the hope that it will be cheapened to him as much as a penny in the dollar.

It must be said, however, that even a telephone monopoly has its merits as well as its defects. It is to the interest of the parent company to experiment, to keep a sharp eye out for improvements in apparatus, making the fruits of the first widely known and securing for its sub-companies the right of using the latter. It was stated at the convention that out of the 600 telephones and 3,000 parts patented here, all that is worth having has been secured and turned over for the use of licensees.

The feature of the meeting was the virtual admission of ignorance, on the part of the parent company, of a recent and apparently highly important discovery in telephony made by one of its sub-companies, as if the telephone octopus was not sufficiently sensitive to feel what is going on at its extremities. On the second day of the meeting, an employe of the parent company, and supposably speaking with authority, declared substantially that, though the telephone has been in operation these eleven years, the bugbear "induction" has not lessened the potency of its grip a jot or tittle. And in the face of that statement, one of the best known among the brotherhood of electricians rose in his seat and declared that nearly all the telephone troubles popularly supposed to arise from induction are the result of leakage only, induction operating at minute distances, while leakage occurs across wide intervals. Then he proceeded with argument and demonstration, the first founded on an assumed theory, but the latter based on practical experiment, the account of which was listened to with close attention. Neither did the discussion following serve to point a fallacy in the argument nor discredit the means used.

To Mr. C. E. McCluer, of Richmond, Va., this discovery, if it really is a discovery, is due. There they have an electrical railway on the overhead wire system, besides an extensive arc lighting system, trying conditions, it is obvious, in which to operate a telephone service. No sooner did he get rid of the lighting current interference when the railway appeared, not, of course, having the same E. M. F. as the lighting current, but what it lacked in electromotive force it made up in current strength. Yet, acting on his theory that the interference was due to leakage rather than to that induction to which it is usually ascribed, he succeeded in absolutely silencing it. He constructed an artificial "earth" by means of a large copper conductor, and his answer concerning the effect of this on one of the worst portions of his line, which, because of the interest excited, he was compelled to pause in his reading to give, is worth reproducing.

Question: "You say you removed the artificial 'earth' wholly from direct influence?"

Answer: "You understand that when this general return wire was used as a general wire, one of the wires on such a tap being connected to this one ground wire, and all seeking earth at the central office instead of at the point where the subscribers' station was located, it reduced the interference from street railway and electric light currents at least 50 per cent; so that when it was only with difficulty that you could make a man understand what you said, with this general return wire we could hear very well indeed."

Question: "That general ground wire was grounded in the central office?"

Answer: "Grounded in the central office, but when made wholly detached from and wholly in place of the earth, they reduced the other 50 per cent or eliminated it entirely. On these stations I spoke of before, the leakage from the electric light wires had been so strong that the subscriber could not use his telephone at night and the operator could not hear him with distinctness when he ordered a connection. Therefore, he told me he never thought of using his telephone after the electric light had been started. As soon as I had this tap connected to one of these artificial ground connections, I sent one of my inspectors to make some experiments. He called me over this general ground wire. The operator heard his order to connect with 180, which is the chief operator's telephone in the central office. I went to the telephone and talked with him without any difficulty at all. Then I removed this plug from the switch and converted that ground wire with all its attached wires into a metallic circuit, and he and I then carried on a conversation in a whisper, of course getting close to the transmitters, as you have to do under these circumstances. But I have just mentioned that to show you the difference between the general ground wire and the metallic surface. Then, when I made him take out the general ground wire and replace the old natural wire, the din from the electric light was so great that he could not hear a word. I then called the subscriber to the telephone, and the very moment I spoke to him he said 'Hello! What have you done here?' I told him I had been experimenting to see if I could not relieve him of the trouble he had been complaining of. He said: 'You have done it.' I then took the plug out of the central office, disconnected the earth entirely, and talked to him over the metallic circuit. He then expressed still greater wonder that the electric light noises were gone entirely; he could not hear a sound of it. I then made some remark in a whisper, which he heard without difficulty, and replied to me in the same way."

In the underground wire discussion it was stated as a self-evident truth that buried wires cannot be expected, because of the conditions of operation, to give as good service as those strung on poles; the air being the best and the ground the worst description of insulation. The transmitter and the battery, too, are prolific sources of trouble. The many contacts in the magnets, bells, and other mechanisms require especial care, and it was suggested that platinum should be more generally used. Wires connecting insulators outside of buildings with instruments inside are often carelessly set, and defective service is frequently charged, when really the trouble is alongside the subscriber; the window connections of his wire being unprotected from moisture. As to underground service, there is little doubt that, as it increases in dimensions, it will bring new difficulties and require more careful and frequent inspection. Because of the certainty of this there was a general feeling evident about the convention that it would be necessary in the future to construct metallic circuits to insure anything like the service that was had with the pole system.

THE LOCOMOTIVE WATER SCOOP.

J. W. B. asks: Is the device for scooping up water for a locomotive, while going at a high rate of speed, an American or English invention? Answer: It is an American invention, patented by Angus W. McDonald, of New Creek Depot, County of Hampshire, Va., November 28, 1854, No. 11,998.

Philip Henry Gosse.

A telegram from London announces the death of Philip H. Gosse, the distinguished English naturalist.

Mr. Gosse was born at Worcester, April 6, 1810, and early developed a taste for natural history. In 1827 he went to Newfoundland, where he remained in mercantile employment eight years, devoting his leisure to collecting insects and making colored drawings from them. In 1835 he settled in Lower Canada, where he resided four years. He traveled subsequently in the United States, and remained nearly a year in Alabama, where he made a large collection of drawings of insects. Returning to England in 1839, he prepared valuable works, entitled "The Canadian Naturalist" (1840), "The Ocean Described," and "Letters from Alabama on Natural History." He resided in Jamaica for eighteen months in 1844–45, and as a result published "The Birds of Jamaica" (1847), followed by an "Atlas of Illustrations" and a volume entitled "A Naturalist's Sojourn in Jamaica" (1851). For several subsequent years he was employed in composing popular books on zoology and allied subjects. He was one of the first persons to give an impulse to the formation of those public and private collections of living marine animals which became popular under the name of *aquaria*, a term probably of his invention. He published two elaborate memoirs on the natual history of the class *Rotifera*, in the "Philosophical Transactions of the Royal Society," and was elected a fellow of that learned body in 1856. He also published "The Natural History of Birds, Mammals, Reptiles, and Fishes" (4 vols., 1848–51); "British Ornithology" (1849, new edition 1853), "A Text Book of Zoology for Schools," and many other books on kindred topics. His greatest undertaking was "Actinologia Britannica: A History of the British Sea Anemones and Corals" (1858–60). His son, Edmund H. Gosse, is an eminent naturalist and Scandinavian scholar.

Continuance of the Yellow Fever.

Contrary to the expectations that were formed, the yellow fever continues its ravages in Florida. The number of new and of fatal cases in Jacksonville shows no diminution, but on the contrary a tendency to increase is discernible. The epidemic seems so firmly established that the outlook for many weeks to come is far from a bright one. The arrival of frost will stop the infection, but if winter has to be waited for, the intervening period will be a severe ordeal for the afflicted regions. A rigorous quarantine is now in force throughout Florida and the adjacent regions, and its effects upon business have been naturally very disastrous.

© 1888 SCIENTIFIC AMERICAN, INC.

The Telephone Convention.

The Telephone Exchange Association, composed wholly of licensees of the American Ball Telephone Company, met in convention at the Hotel Brunswick, in this city, on Tuesday, September 4th, and Wednesday the 5th. Papers on the theory and practice of telephony were read and commented upon before a large and attentive audience.

Mr. C. E. McCluer, of Richmond, Va., in an instructive paper on "Dynamo Current Interferences with Telephone Systems, and Means of Relief," said in substance that he once believed in the theory now usually accepted that the earth is an immense reservoir of electricity, but because of the behavior of telegraphic apparatus under the influence of extraneous currents he is led to question the correctness of the theory of the infinite conductivity of the earth. He had also been led into the error of attributing the many ills of the telephone to "induction," but experience had convinced him that nearly all these are the result of leakage, induction operating only at minute distances, while leakage will occur across wide intervals. Recent experience with electric lighting currents has confirmed him in these views. When a few years ago the electric light came to Richmond, telephony became disturbed with strange noises. He first attributed the telephone disturbances to induction, but his linemen discovered that even in the driest weather enough of the dynamo current on a large arc light circuit escaped over the insulators and down the poles to be perceptible to the tongue when applied to a pole four or five feet from the ground, while in rainy weather a very perceptible shock could be felt by applying the hand to a wet pole. He decided that leakage and not induction, as this is always called, was the force to be dealt with, being confirmed in his opinions by the fact that the interferences were greatly increased during wet weather.

On January of the present year, a long electric railway was started in Richmond, having no metallic circuits like light and power systems, but mixed earth and metallic circuits, the current carried to the overhead trolly wires by a system of distributing mains on poles and connected frequently with the trolly wire by short lateral wires or feeders.

In six weeks we had eight sets of telephones and one central office annunciator burned out by these railroad currents, most of them due to crosses between the telephone wires and the supposed to be harmless wires [non-electric wires running across the streets and joining the line of poles on one side with the line on the other]. The effect of this railway has been and is a serious obstacle to the telephone system. At the generating station of the railway, three squares away from the central office, the battery of five or six dynamos was grounded, the negative electrodes connected to several large sheets of copper at the bottom of a deep well. The positive electrode of the dynamo, coupled up in multiple arc, being connected "to air" or to the distributing mains. In all our exchange stations in the vicinity we got a negative leakage current, while at the more distant ones we got a positive one; it being, therefore, impossible to arrange our galvanometer batteries to coincide with these leakage currents of opposite polarity. The galvanometers cannot today be used for testing off the stations near the generating station. He found the railway people were utilizing the municipal gas and water mains in order to re-enforce their ground connections, and thinking it might be a cause of trouble, his company similarly grounding their lines, he had them directly connected with the earth, but without altering the result.

The 500 volt currents of the railway do not interfere so much as the 4,000 volt currents of the arc light. What the railway currents lack in E. M. F., however, they make up in current strength, and are therefore more dangerous to property than the more intense light currents. The greater tension of the electric light currents, he thinks, makes them disastrous to telephonic exchange service. Acting upon his theory that telephone troubles are due principally to leakage from light and railway wires rather than to induction, the leakage overflowing in the wires from the earth because the earth offers an appreciable resistance to the passage of the currents, he adopted a metallic conductor of exceedingly low resistance and approximating that of the earth, using it in place of the earth as the return conductor, an "artificial" ground, cutting loose from the earth wholly, with all the benefits of metallic circuits. The result he says is altogether successful.

Mr. L. F. Beckwith, of the New York Subway Construction Company, gave some interesting facts on the New York subways. He said that, with the exception of the Edison, they are all built on the "drawing-in" system, being groups of ducts extending between a series of manholes. He believed experience had shown that a main conduit of separate pipes that may be crowded or curved or kept apart is best adapted to overcome the many obstacles met with in the ground. Screw-jointed, asphalted wrought iron pipes, laid preferably in hydraulic cement concrete, give most tightness of duct against gas and water with greatest strength. The cement pipe and creosoted wood tubes have also some valuable features. In some places they had met a steam heating company's pipes and had great difficulties because of them, the steam constantly escaping, and, therefore, not permitting the use of materials of construction melting or softening at from 160 degrees to 200 degrees on Fahrenheit's thermometer. Non-metallic and metallic ducts five miles long have been purposely constructed, that the telephone people may have a chance to experiment as to their influence on low tension currents. The work done up to the 1st of the present month is here given:

Dorsett ducts, coal tar concrete	235,837 feet.
Zinc tubes laid in hyd. cement concrete	68,883 "
Creosoted wood tubes	167,175 "
Cement pipe laid in hyd. cement concrete	216,626 "
Iron pipe laid in asphaltic concrete	131,284 "
Iron pipe laid in hyd. cement concrete	1,423,722 "
Iron distributing pipe	23,301 "
Edison iron tubes	222,794 "
Grand total length of single duct	2,489,602 feet.
" " "	472 miles.
" " " trench	37 "
Number of manholes	523
Total length telephone and telegraph ducts	376 miles.
" " electric light ducts	96 "
Length of telephone and telegraph trenches	19½ "
" " special electric light trenches	17½ "

About three-fourths of a million feet of single duct for telephone, telegraph, and electric light purposes authorized by the Board of Electrical Control remains to be built.

For telegraph purposes an iron pipe from a manhole connects underground with a building or with the foot of a pole. For telephone purposes the above method is used, and a pipe runs up the face of a building to the roof, where from a fixture the cable is divided for distribution on the block and surrounding blocks. Sometimes the pipe is carried up through an elevator or ventilating shaft. In the down town district, and along Broadway to Union Square, an iron 3 inch pipe is laid in the trench above the subway, provided at intervals of about 50 feet with malleable iron circular distributing or service boxes with screw covers 12 inches in diameter, with side outlets through which a cable can be conducted by a service pipe into the buildings.

For electric light distribution the Edison Co. have their special system laid. A cast iron distributing conduit with 6 ducts and flush boxes has been authorized to be laid in Broadway from Fourteenth Street to Thirty-fifth Street. Up to August 27th, 1888, there were 3,567 miles of wire laid in the subways by the Metropolitan Telephone and Telegraph Co., and a 100 wire lead-covered cable from Whitehall Street to Fifty-eighth Street, about 6 miles, and the longest of this size in existence underground. The Western Union Co. have about 100 miles of wire underground, and the Edison about 126. The Brush Co. are putting an 8 conductor cable in the Broadway conduit from Fourteenth Street to Thirty-fifth Street, making 8 miles of electric arc light wire.

Mr. W. D. Sargent, engaged in constructing the Brooklyn subways, sent a paper on the subject. He says the first section of the creosoted wooden conduits, which have been used four years, do not show any evidences of decay, the ducts remaining clean and dry, and the cables drawing in and out easily. Three-inch ducts he thinks the best. Of the cables laid four years ago, those covered with pure lead have been more than half eaten through. One just drawn out, and only two years buried, is badly corroded. Those with a mixture of tin show only slight corrosion. He thinks that if in addition to the tin, cables were drawn through a bath of gas tar or asphaltum, then covered with a good stout braid, and again run through the bath, they would be practically imperishable. The greatest length of cable now underground in Brooklyn is 11,800 feet, between the Bedford and Williamsburg offices, of 100 wires, twisted in pairs, the pairs broken up at all the splices, conductors 0·035, insulated to 0·075. The insulation of this cable is 39 megohms per mile; capacity, 26 microfarads; resistance of the construction, 47 ohms per mile.

The electrical qualities of this two miles cable are: insulation 50 megohms, capacity 52 microfarads, resistance of conductors 94 ohms. There have been and still are many complaints of the imperfect working of this cable, but he is inclined to attribute the trouble to other causes rather than inefficiency on the part of the cable itself. The Dorsett conduit, of which much was expected, he says, has proved very unsatisfactory. They have five miles of it, with ducts two inches in diameter, and these, because of irregularities at the joints, will only permit of a cable 1¼ inches in diameter being drawn in.

As the mileage of underground wire increases, the obstacles in the way of good service will be increased. The actual extent of the Brooklyn underground wires was on September 10:

Length of conduit	15·17 miles.
" " duct	105·5 "
" " cable	22·93 "
" " conductor	2·053·3 "

1913 subscribers are using underground wires, the length of the latter being 1229·9 miles.

E. F. Sherwood of the Metropolitan Telephone Company of New York City, said they were serving 7,300 subscribers. They are using what they call trunk calling wires between the several exchanges, one ending at John and the other at 39th Street, for calling all trunk connections to the many exchanges operated by the company. The number of trunk wires connecting the exchanges in New York City is 532, and average 60 connections a day. This average could be increased to 70 per day, the number of subscribers could be increased 600 without increasing the trunk facilities. To other exchanges the Metropolitan has 187 trunk lines, all running smoothly, including the new Brooklyn exchange of the New York and New Jersey Telephone Co. The new switch board at 18 Cortlandt Street is wired for 5,100 subscribers and 900 trunk wires. The local battery of each operator's outfit will be two cells of storage battery, one for day, the other for night. That used by day will be charged at night from the main storage battery, and the night battery charged from a dynamo during the day. 1,527 miles of wires are now underground, and 2,784 separate wires are altogether or in part so working.

A New and Remarkable Gas.

A new gas, possessing some remarkable properties, has been discovered by Prof. Thorpe and Mr. J. W. Rodger, in the research laboratory of the Normal School of Science. It is a sulpho-fluoride of phosphorus of the composition PSF_3, and is termed by its discoverers thiophosphoryl fluoride. The best method for its preparation consists in heating pentasulphide of phosphorus with lead fluoride in a leaden tube. It may also be obtained by substituting bismuth fluoride for the fluoride of lead, the only difference between the two reactions being that the second requires a higher temperature than the first. Again, when sulphur, phosphorus, and lead fluoride are gently warmed together, an extremely violent reaction occurs, but if a large excess of the fluoride of lead be employed a tolerably steady evolution of the new gas occurs, the excess of the lead salt appearing to act as moderator. It is an interesting fact, throwing considerable light upon the constitution of the sulpho-fluoride, that it may be obtained by heating together to 150° C. in a sealed tube a mixture of the corresponding chloride—thiophosphoryl chloride, $PSCl_3$, a mobile colorless liquid—and trifluoride of arsenic. The simple exchange of chlorine for fluorine here brings about a striking physical change, from a highly refracting liquid to a colorless gas. And now for the remarkable properties of the gas. In the first place, it is spontaneously inflammable. If it be collected over mercury, upon which it exerts no action, in a tube terminating above in a jet and stop cock, and the latter be slowly turned so as to permit of its gradual escape, the gas immediately ignites as it comes in contact with the air, burning with a greenish yellow flame tipped at the apex with blue. If, however, a wide tube containing the gas standing over mercury be suddenly withdrawn from the mercury trough, the larger mass of gas ignites with production of a fine blue flash, the yellowish green tint again being observed as the light dies away. Thiophosphoryl fluoride is readily decomposed by the electric spark with deposition of sulphur. If a quantity contained in a tube over mercury be heated for a considerable time, complete decomposition occurs, sulphur and phosphorus both being deposited upon the sides of the tube and gaseous silicon tetrafluoride left. From a spectroscopic examination, dissociation was shown to occur at the lowest temperature of the electric spark. The gas is slowly dissolved by water, and appears to be somewhat soluble in ether, but alcohol and benzene exert no solvent action upon it. Finally, the colorless, transparent gas was reduced to a liquid, somewhat resembling the sulpho chloride, by means of Cailletet's liquefaction apparatus.—*Nature.*

Suggested Improvement in the Manufacture of Paper.

It has often been stated that the cause of paper becoming brittle or tender is to be found in the presence of alum or sulphate of alumina in the paper. Herr C. Wurster's observations, according to the *Papier Zeitung*, extending over ten years, tend to the conclusion that neutral or basic sulphate of alumina exercises no decomposing influence at ordinary temperatures on paper, whether size be present or not, but that sulphate of alumina has a strongly caustic action if chlorides, such as those of sodium and calcium, be present, especially at higher temperatures. In this case an injurious action on the paper arises from the formation of aluminum chloride or free hydrochloric acid, which acts by abstracting hydrogen, or the elements of water, from the cellular substance. The manufacturer should therefore endeavor to remove, as far as possible, by washing from the fabric any sodium or calcium chloride resulting from the bleaching powder. It is accordingly not advisable to kill the bleach by antichlor without subsequent washing. From these considerations, the testing of paper should include a qualitative or quantitative examination of the chlorides present, which, the *Journal of the Society of Chemical Industry* says, have hitherto been regarded as quite harmless.

© 1888 SCIENTIFIC AMERICAN, INC.

FERDINAND DE LESSEPS.

Vicomte Ferdinand de Lesseps, now in his eighty-third year, is the very personification of energy and perseverance, and will figure in history as one of the world's boldest engineers. When, in 1831, he was sent as consul-general to Alexandria, he found the idea of a canal across the Isthmus of Suez a fertile topic of discussion, and, becoming deeply interested in the subject, he proposed to Mehemet Said, with whom he was on intimate terms, a plan for executing the project; but it was not till 1854 that his enterprise received the official sanction of that potentate. The opposition that he received from England, the obstacles placed in his way by the Sultan and the Porte, and the success that finally crowned all his efforts, when the Empress Eugenie opened the canal in November, 1869, are well known matters of history. Having accomplished this great work, M. De Lesseps determined to retire for a time on his well earned laurels, and a few days after the inauguration of the Suez Canal he married a young Creole lady, Mlle. Helene Autard de Bragard, by whom he has had nine children.

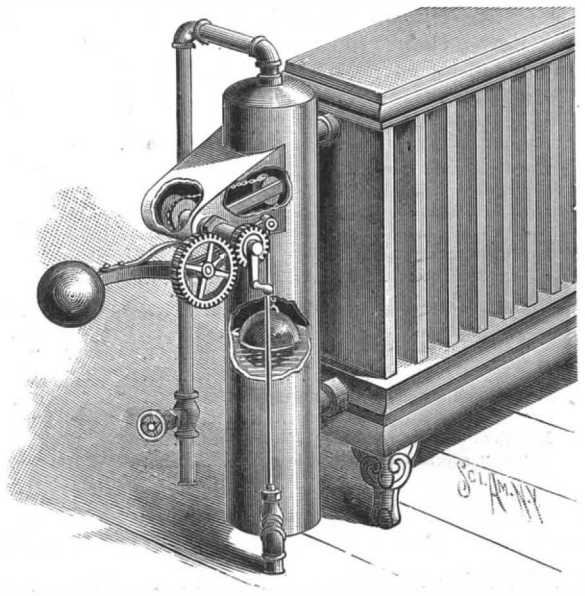
Honors now began to fall thick and fast upon him. He received the grand cross of the Legion of Honor from Napoleon III., who had always befriended him. England now tried to make amends by according him an enthusiastic welcome on his visit in 1870, when he received the grand commandership of the Star of India and the freedom of the City of London. In 1878, the long discussed question of the Panama Canal came to the front, the committee of investigation handed over its concession to M. De Lesseps, the International Scientific Congress proclaimed that the project could and ought to be carried out, and, in December, M. De Lesseps and his wife and children (the latter then three in number) started for the isthmus to inspect the route for himself. He returned, after some months' absence, thoroughly impressed with the practicability of the scheme. At first, it was found difficult to procure funds, and the scheme was abandoned for a time; but, finally, a company was formed, and the French engineers left Paris on the 3d of January, 1881, to proceed to the work, which was begun February 24 of the same year.

The enterprise has since been carried on under many vicissitudes, due to the geology of the country and lack of funds. The latest project is to abandon the dead canal for a time and to construct a temporary lock canal.

M De Lesseps has been twice married. Our engraving shows the old hero and his young wife and their children. For the engraving we are indebted to the *Illustrated London News*.

A REGULATOR FOR STEAM RADIATORS.

An improved device for controlling and regulating the heat given off by a steam radiator is illustrated



BRITTS' RADIATOR REGULATOR.

herewith, and has been patented by Mr. Peter W. Britts, of Gunnison, Col. The radiator is connected at its top and bottom with the upper and lower ends of a tank placed near, thus establishing a steam and water connection whereby the water level is kept the same in both, the tank being connected at the top with the steam supply pipe, and having at the bottom a water outlet pipe in which is a gate valve. The valve rod in the outlet pipe is pivotally connected with a weighted lever fastened on a sleeve turning in bearings on a hollow branch arm extending from one side of the upper end of the tank, a shaft passing through the sleeve carrying on its outer end a pinion meshing into a gear wheel turning on a stud secured on the weighted lever. A spring pawl on the lever arm engages the teeth of the gear wheel, to prevent a return movement of the pinion and its shaft, and the latter has on its outer end a crank arm, while on its inner end, inside of the branch from the tank, is a drum on which winds one end of a chain or rope passing over a pulley held on the free end of an arm secured to the sleeve. This arm, the sleeve, and the weighted lever thus form one piece, so that when the arm swings downward the weighted lever swings upward, and *vice versa*. The pulley projects into the tank, and the rope or chain passing over it carries at its lower end a weighted float, which rises and falls with the water level in the tank and in the radiator. The float can be raised or lowered and adjusted at any desired height by means of the crank arm and pawl, a pointer on the gear wheel indicating the height of the float in the tank. The weight of the suspended float holds the weighted lever arm normally in position, so that the valve in the outlet pipe remains closed, as the water of condensation accumulates in the radiator and the tank, until the water raises the float, when the weighted lever arm swings downward, and the rod pivotally connected therewith opens the valve in the outlet pipe. The float moves downward with the falling water, and again exerts its pressure to close the valve when sufficient water has escaped. By adjusting the position of the float the height of the water may be varied as desired, thus increasing or diminishing the steam space and regulating the heat given off by the radiator.

Hot Weather in India.

On the 10th of May, North Sind and West Rajputana were the hottest parts of the Indian region, the maxima of temperature generally exceeding 110 deg. On the 12th idem the maxima at Jhansi and Deesa were 112·5 deg. On the 13th the highest maxima reported were 114 deg. at Deesa, and 113·5 deg. at Jhansi. On the 14th the temperature had again risen; the highest maximum was 114·7 deg. at Jacobabad. *Indian Engineering* says, "On the 15th the maximum at Jacobabad was 116·6 deg., at Hyderabad—Deccan—it was 113·2 deg. On the 16th a maximum of 116·6 deg. was reported from Jacobabad, of 115·9 deg. at Sirsa, of 115·4 at Deesa, and 114·8 deg. at Ludhiana."

ABOUT 400 barrels of crude petroleum are being turned out daily by the twenty-two wells of the Pacific Coast Oil Company in the Pico district, near Newhall, Cal. The wells of the company are now sunk to a depth of from 1,600 to 1,800 feet. The oil is of the best quality obtained on the coast, and the demand for it is very great. Some of the new manufactories at San Francisco burn oil instead of coal.

M. DE LESSEPS, PROJECTOR OF THE PANAMA CANAL, AND HIS FAMILY.

© 1888 SCIENTIFIC AMERICAN, INC.

The Use of Two Doors in a Trap Door Spider's Nest.

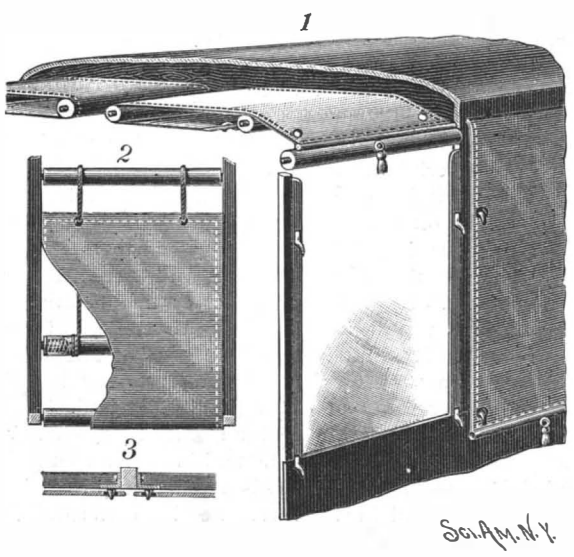
BY GEORGE F. ATKINSON, COLUMBIA, S. C.

Certain of the species of *Nemesia*, the habits of which Mr. Moggridge studied, make two trap doors to their nests, one at the surface of ground at the upper end of the main tube, the other a short distance below, at the beginning of a branch tube. Mr. Moggridge supposed the use of the branch and second door was to afford the spider a means of escape when pursued by an enemy. When chased into the main tube, the spider would go into the branch and close the door; the enemy following, and finding the main tube empty, would leave.* In my studies of the nests and food habits of *Myrmekiaphila foliata*,† I found indications that the main tube was constructed to serve as a gallery for the passage of ants or other insects, and that the branch was constructed as a real trap, in which the spider awaited the passing of an ant, when it would open the door and catch the insect. The arguments I then advanced, briefly stated, are: 1st, the nests then found were all made in places where ants had underground passages; 2d, the main tube connected with some of the ants' galleries; 3d, the trap door at the surface of the ground had the appearance of being little used; and 4th, one nest had only one door leading into a short tube. This tube opened into the floor of a broad hall of the ants' nest leading into several galleries. Near this broad hall was the opening to the surface of the ground, made by the ants, and through which the spider probably entered the hall to construct her "branch tube" in the floor.

In May, 1888, at Chapel Hill, N. C., I found a nest of *Myrmekiaphila foliata*, under conditions which seem to give conclusive evidence that the main tube is intended to entrap unwary insects, that they might be "gobbled in" as they pass the door of the branch where the spider remains. The nest was made in a broad foot-path, where the clay soil was very hard. I discovered it by seeing the open door. The following day I visited the place with trowel in hand to dig up the spider. I found the door still open. The main tube was about nine inches long, the branch about one inch long, and was situated six inches from the surface of the ground. In this I found the spider. The door to the branch was a *cork* door, while that at the surface of the ground was a *wafer* door. It appears in cases where the nest is not made in an ants' nest, that the outer door is set open, thus offering an attractive place for insects that are crawling on the surface of the ground in search of food. They enter the main tube, and as they pass the branch the door is suddenly thrown open, and to their surprise they are taken captive and made a meal of by the cunning spider.—*Psyche.*

AN IMPROVED VEHICLE CURTAIN.

A curtain for top carriages and similar vehicles, which can be quickly adjusted to close in the top, and raised completely out of the way when not needed, is shown herewith, and has been patented by Mr. John H. Shaubach, of No. 281 Livingston Street, Brooklyn, N. Y. Close to the top of the window openings on each side, between the successive roof-supporting posts, is journaled a guide roller, a similar guide roller being journaled on each side of the central longitudinal roof brace, while a spring winding roller is also journaled to brackets on the cross braces between each two guide rollers, as shown in Figs. 1 and 2. A flexible curtain or shade, having its inner edge stiffened, is connected at



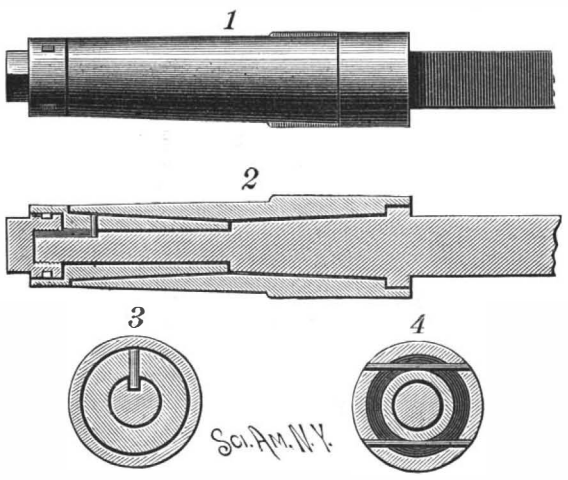
SHAUBACH'S VEHICLE TOP CURTAIN.

one end by cords to the spring roller, the other end of the curtain being passed inward around the inner guide roller, and outward over the outer guide roller, between the latter and the edge of the roof. The spring roller will normally draw almost the entire curtain up beneath the roof, but so that it will be held in position to be seized for lowering in opposition to the tension of the spring. The opposite side edges of the curtains have eyes to receive downwardly projecting hooks fixed to the posts at the side, as shown in section in Fig. 3, to hold the curtains down, they being automatically rolled up by the spring roller when released from the hooks.

* Harvesting Ants and Trap Door Spiders.
† Entomological Americana, Oct. and Nov., 1886.

AN IMPROVED VEHICLE SPINDLE.

A vehicle spindle designed to fit always snugly in the bearing without any play, thus causing the wheel to last longer, and preventing noise, is illustrated herewith, and has been patented by Charles V. Moore, M.D., of Fairmount, Ind. The axle has a collar from which extends a conical spindle, which has a straight extension, screw-threaded on its outer end, as shown in Fig. 2. The axle collar fits into a recess on the inner end of a bearing, to be secured to the hub of a wheel, the conical spindle fitting into a corresponding opening in this bearing, while the further extension of the axle passes through a sleeve, conically shaped on its



MOORE'S AXLE SPINDLE AND BEARING.

outside, and fitting into a similarly shaped opening in the bearing. The sleeve extends with its small end to within a short distance of the small end of the conical spindle, and near the outer end of the small portion of the axle is formed a groove into which extends a pin secured to the sleeve, as shown in cross section in Fig. 3, so that the sleeve is prevented from turning. On the outer threaded end of the axle screws a nut extending into a recess in the enlarged end of the sleeve, this enlarged end abutting against the outer end of the bearing. On the nut is an annular recess through which pass pins held in the end of the sleeve, as shown in Fig. 4, to hold the nut in the sleeve for convenience when removing the wheel. The sleeve is thus held by the nut in a snug position in the bearing, all wear on the sleeve and spindle being taken up by adjusting the nut on the threaded outer end of the axle, so that the spindle always fits its bearing.

A Noiseless and Smokeless Locomotive.

At Palmyra, Wis., about forty miles northwest of Milwaukee, there may be seen to-day a new, small locomotive engine (but large enough to draw several street cars), the construction of which is so different from anything which has preceded it as to be a genuine surprise to the man of science as well as to the practical engineer. Except the noise of its wheels moving upon iron rails, it is noiseless and smokeless. The fuel, any kind of wood or coal, is perfectly consumed. The steam, after use in the engines, is condensed in a new manner, and the water at the boiling point is reused. The performances of this remarkable piece of mechanism are so startling as, naturally, to cause a statement to be received with incredulity by those who have not witnessed them. To see and experiment with a locomotive which starts, stops, and reverses its direction of movement so silently and easily that, if your eyes are closed, you cannot detect the instant when the direction of motion is changed is a strange experience, and tells more plainly than words that the phenomenon before you may mark an era in the history of engines and motors. The objections to the ordinary locomotive which I have enumerated above are all overcome in the new engine. The rigid bases and all the shocks incident to a rough and uneven track are absent. All the wheels of the new locomotive are drive wheels and all its weight is traction weight. The necessity for a front guide truck does not exist, the drive wheels being so arranged as to give them easy control of the car on curves and on uneven tracks.

The most surprising feature of this locomotive is that there is very little waste of steam, heat and water in operating it, as the steam is not thrown away after using, but the water of condensation is returned to a high pressure boiler and reused over and over again with but small loss of heat. The noise incident to a forced exhaust, common in the old system, is done away with here. The combustion of fuel is so complete that no smoke exists. The side motion and jarring felt in the ordinary engine is done away with, and stopping and starting and reversing the motion of the engine are very easily accomplished.

This engine runs equally well in either direction. One supply of water and fuel is sufficient for half a day's run or even a longer run. Nothing is wasted, which means an economy in operation never before approached in this class of machines. In answer to the claim made that it is very difficult, if not impossible, to pump boiling water, I can only say that this is easily done in this engine every day, as any investigator can see for himself.

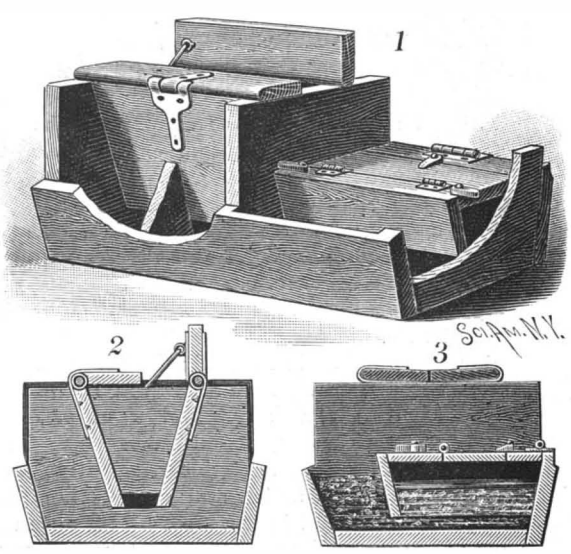
I have purposely avoided going into details of a technical nature, my object being to state results only. The advantages of this new locomotive over the ordinary one are many and revolutionary in their importance. It need not be much more than half as heavy as the present ordinary locomotive engine, and the cost of operating it is so much less as to astonish engineers. Noiseless, smokeless, and cinderless, it can be used in the crowded streets of cities without objection and with none of the disadvantages of the common grip car. The inventor is Mr. T. T. Prosser, of Chicago, who is widely known as a mechanical expert and engineer. The Palmyra Manufacturing Company are engaged in building a second locomotive of this type, which may be exhibited in Chicago and New York. It seems to mark an era of great advance in the uses of steam, and nothing which the last half century has seen in this line has attracted the attention which will be directed to this new locomotive the moment its remarkable features are fully made known to the mechanical and industrial world.—*Duane Doty, in Railway Age.*

Palace Cars for Hens.

One of the latest improvements in the transportation of poultry is a patent palace car on the Lackawanna Railroad, designed for the conveyance of live fowl. According to the *Railway News*, the car is two feet higher than the ordinary freight car, contains 116 compartments, each one four feet square, in a series of eight decks, with an aisle running through it crosswise and another one lengthwise. The capacity of the car is from 3,500 to 4,500 fowls, according to the season of the year. By a system of drop decks the fowls are loaded and unloaded at the bottom of the car, the sides of which are of strong wire netting, in which are the doors to the several compartments. On the top of the car in the center is a water tank large enough to supply a full load on a journey of 2,000 miles. Each compartment is supplied on three sides with abundant food and water, by a system of troughs and hose that is easily worked on the inside, no matter how great a speed the train may be going at. The food is carried in a box or tank beneath the car.

AN IMPROVED FEED TROUGH FOR STOCK.

A convenient receptacle from which dry or wet feed may be fed to stock, and which can be easily kept clean, and the contents protected from dust and the weather, is illustrated herewith, and has been patented by Mr. William Andrus, of Reedsburg, Wis. The side pieces of the main feed hopper are tenoned or otherwise secured in standards which constitute the ends of the hopper, in which there is a partition, the lower ends of the hopper side pieces converging, and being elevated a distance above the bottom of the trough, as shown in Fig. 2, the main feed hopper having hinged lids adapted to conjointly cover its entire top. With this construction, the dry feed placed in the hopper is supplied to the trough only as consumed. Adjoining the main feed hopper and trough is a compartment



ANDRUS' FEED TROUGH.

adapted to be utilized for wet feed, and especially designed for feeding swine, the construction of which is shown in Fig. 3. The shape of the box, and a central partition therein, are designed to effectively prevent the swine from introducing foreign matter into the bulk of the feed or wallowing in it.

APPLYING kerosene with a rag when you are about to put your stoves away for the summer, will prevent them from rusting.

© 1888 SCIENTIFIC AMERICAN, INC.

INSTANTANEOUS PHOTOGRAPHY.

(*Continued from first page.*)

adjusted to the right focus when rotated to the right or left by the use of a special implement or tool. It is only done when the mechanism is put together, since the lens is placed at a fixed focus, but it goes to show how carefully the matter has been studied. Every object beyond three feet is in focus even to the extreme distance, and it is truly remarkable how distinct each portion of a picture is.

After each camera is finished, it is practically tested by photographing on the film some object like printed matter at four, fifteen, and fifty feet distant. Each resulting negative is then examined with a magnifying glass, and if not perfect, the lens is adjusted and repeated tests again made until it is exact. No finder is attached to the apparatus, it being deemed unnecessary.

In operating the camera we first remove it from the neat leather carrying case, provided with a shoulder carrying strap, shown in Fig. 3, then pull up once or twice, with the fingers, the winding cord, which, as before explained, winds up the shutter spring. We next remove the cap from in front of the lens (not shown in the engravings), and hold the camera steadily with the two hands as in Fig. 4, having the thumb of the left hand resting upon the trigger pin on the side of the camera, and aim the apparatus at the object we wish to take.

Immediately the pin is pressed, the shutter revolves and the exposure is made. We then with the right hand turn the key on top to the left and observe the movement of the little mark on the upper end of the axis of the supply spool, winding until it has made one revolution with respect to the mark on the round plate, as seen on the exterior of the camera case in the large engraving.

The exposed film has thus been wound off and a new film put in its place, ready for another exposure. A pull or two on the little cord winds the shutter spring up, and the operation of exposing is again repeated.

So easy and rapid are all the movements that it is believed from ten to twenty separate exposures may be made in one minute. To fix the shutter for a time exposure, we press repeatedly on the releasing pin until the shutter stops revolving. During this time the front of the camera should be in contact with the clothing to prevent light from entering. We then with the finger move the shutter until its aperture is opposite the lens. The cap is next placed over the lens, and we locate the camera on a table or other convenient resting place, and make the exposure in the ordinary way, by removing and replacing the cap.

Accompanying the apparatus is a very complete printed blank book for recording the exposures, and a card having printed on it an angle diagram to enable one to readily determine how much of a given view will be taken in. There are also ample directions provided for developing and finishing the exposures.

The new "Kodak" system is based on the fact that the purchaser need not work the chemical process unless he wishes to or has the time to spare. After the 100 exposures have been made, or only a part of them, the whole apparatus may be sent to the manufacturers, who will remove the exposed paper, develop the negatives, print the positives and return the camera refilled for another 100 exposures, together with the negatives and the 100 positive prints, in a few days. Or the owner may remove the spool of exposures himself in a suitable dark room, send by mail to be finished, and insert a fresh supply.

The finished negatives, being transparent like glass, may be readily enlarged from on bromide paper, so that there need be no objection as to the small size of the pictures. They also answer admirably for making lantern slides by contact.

It will thus be seen the uses of this little apparatus are numberless; it may be used anywhere and everywhere, so long as there is light enough to make a picture.

Yachting trips may be illustrated; the pleasure of journeys through foreign countries will be increased by knowing that any novel sight the traveler may see can be caught and preserved to show to his friends. The doctor, engineer, scientist, merchant, lawyer, minister, artist, and many other professional persons will find in it a most useful adjunct, while for affording endless amusement to young people, nothing could be devised that would be more profitable and interesting. We have personally tested the apparatus and regard it as most ingenious, simple, and useful. It is certainly a credit to the manufacturers, and we predict for it a very general use.

Considering the many advantages to be derived from the apparatus, its expense is very small. It was recognized quite recently as one of the most important inventions of the year at the Minneapolis Convention of the Photographers' Association of America, in July; a special medal having been awarded at that time to its manufacturers.

Furnished with the apparatus is an illustrated primer, containing specimen photographs and other useful hints about the use of the camera. We understand this attractive book will be sent gratis to all interested.

Further information may be had by addressing The Eastman Dry Plate and Film Company, Rochester, N. Y.

Self-Extinguishment of Fires.

The apparatus which is most promptly used in cases of burning buildings, and also with the least efficacy, is the human voice, notwithstanding the historical fact that blowing has accomplished nothing since the days of Jericho. Yet there are numerous instances where fires have been extinguished through causes connected with their origin, and so completely outside of precedence that they serve as instances of the happening of the unexpected. In this connection we do not refer to the fires extinguished by automatic sprinklers, where the result is clearly what has been expected to happen. Notwithstanding the fact that when a fire occurs on property protected by automatic sprinklers, those present avail themselves of all the means of grace in the shape of the usual fire apparatus at hand, yet there are numerous instances where fires have occurred at night or in rooms vacant at the time, where the fact has been made known only by water percolating through the floors, or the sound of the automatic fire alarms, or from the sprinklers which have already come into active operation, the fire having called down means for self-extinguishment. But the instances which we have in mind are those where the means of extinguishment were not expected, as in the well known Cathedral building in Boston, where a fire, caused by spontaneous ignition in a store room, melted the lead water pipes, and the water issuing from them extinguished the fire. A similar instance happened in a building in Market Street, Philadelphia. Some sheet metal pails were returned by the purchaser to a tinsmith in Chester, Pa., with the complaint that they were not tightly made. The manufacturer resoldered them, and in order to test his work filled them with water and hung them upon hooks at the ceiling. While the men were at dinner during the noon hour, a fire heated the upper part of the room so that the bails connecting the handles to the pails became unsoldered, and the dropping of the pails of water dashed out the fire.

Some waste left upon the top of a steam pump at Watertown, Mass., blazed from spontaneous ignition, and this in turn set fire to the lagging around the steam cylinders and the feed pipe, where it melted the soldered attachments of a continuous automatic oiler. The steam from the feed pipe was discharged through the small tubes formerly leading to the oiler, and extinguished the fire. There have been numerous instances of fires which have ceased for want of air. During the war of the rebellion, attempts were made to burn New York City, as the result of a conspiracy, fires being started in several hotels; but in order to prevent premature detection, the culprits closed up the rooms so tightly that the fires were smothered. At a hotel in Woonsocket the steam pipes caused a fire in the spaces in the walls of the building, which was extinguished for want of air to support combustion. The time of the fire is unknown, as its occurrence was not discovered until some time afterward, when in the progress of an alteration to the building the facts were made apparent. It may be interesting to know that in this instance the steam heating service was ordinarily used at a pressure of about 4 lb. to the square inch during the coldest weather, and that the safety valve was so arranged that the pressure could never exceed 10 lb. A spark of static electricity proceeding from a belt ignited leaking gas, and this in turn set cotton on fire, which operated the automatic sprinklers and extinguished it. An attempt was made to destroy a block of new dwellings at Brookline, Mass., before the buildings were entirely finished. Some people, alarmed by the smoke which was seen in each division of the structure, rushed in to save doors and portable fixtures, when it was noticed that the fires did not appear to gain any headway, and when the smoke had entirely died away, it was found that the incendiary had placed lighted candles in sawdust and other inflammable material in drawers and closets, but with such limited supplies of air that combustion could not be supported and the fires became smothered.—*Engineering.*

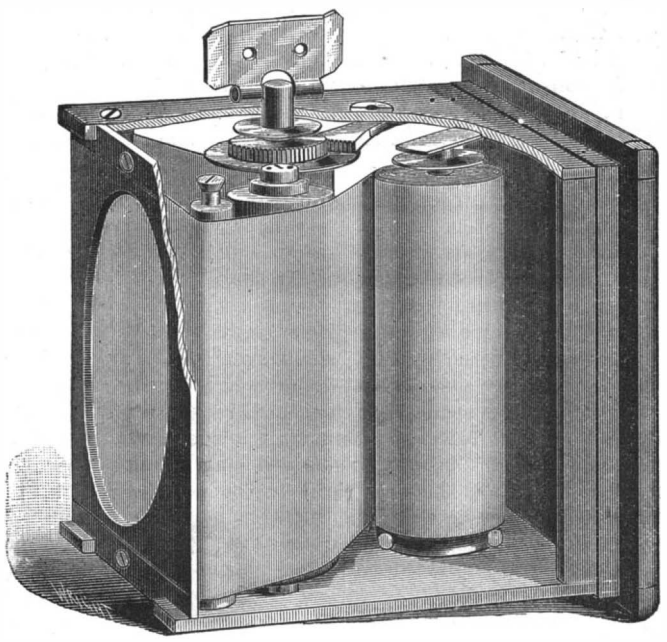


Fig. 2.—SUPPLY BOX OF THE KODAK CAMERA.

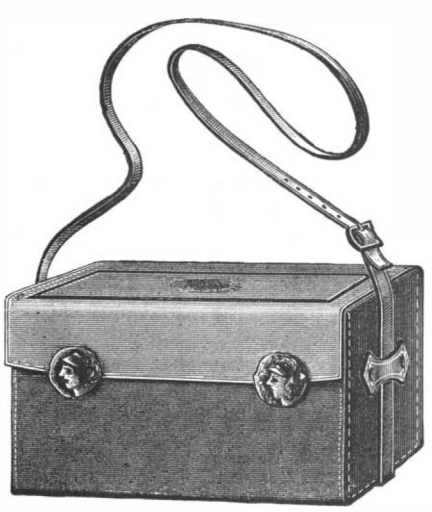


Fig. 3.—THE KODAK CAMERA CARRYING CASE.

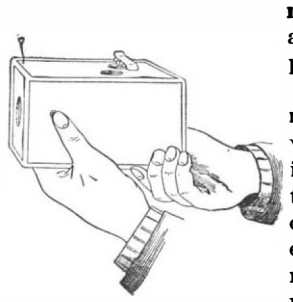


Fig. 4.

Fires Caused by Kerosene.

The annual report of the fire marshal of Boston has caused much interest in the fact which it develops that nearly one-tenth of the fires that occurred in Boston during last year were due, directly or indirectly, to the explosion or accidental lighting of kerosene oil.

The number of fires occasioned by the use of kerosene oil suggested the possibility that the oil used in lamps and stoves was not as safe an article as it might be. Purchases of oil were accordingly made at the places where those who had suffered a fire from this cause alleged that they obtained their supplies, and the samples thus collected were submitted for test to Professor Norton, of the Institute of Technology, and to Professor Chandler, of Columbia College. These two authorities reported that the samples of kerosene oil submitted to them for examination were far below the standard required by the State for lighting purposes, that is, a flashing point of at least 100 degrees Fah. and a burning point of at least 110 degrees Fah. This is certainly a low enough standard, and ought to be raised.

A curious thing about the matter is that similar samples were submitted to one of the oil inspectors, with the result that he found that the oil tested far above the standard which the State had established. It has been found that greatly varying results may be obtained in these tests by different methods of procedure, and it seems reasonable that means should be required, by law, to be used in making tests of the flashing and burning point of oil, which should afford an absolutely safe criterion by which to judge the oil. Safety to the public would seem to demand that an oil which gave off an explosive vapor, no matter how these conditions were reached, at less than 100 degrees should be classed as an unsafe oil, even though it might be manipulated by an official inspector so as to keep its vapor to itself until a higher temperature had been reached.

The Boston *Herald*, in commenting upon this matter, criticises the provisions of the law under which inspectors operate. The fees for inspecting the oil are paid by the owner of the oil, and this places inspectors practically under the employ of the Standard Oil Company, and there are ways enough to make it unpleasant for inspectors who make a report unsatisfactory to the great monopoly. It is likely that the laws of Massachusetts are very much the same relating to this matter as those of other States. It is desirable that the position of oil inspector should everywhere be independent, so there shall be no hindrance to a rigid and righteous inspection. This much the public has a right to demand in the interest of its own safety.—*American Artisan.*

What is a Sleeper?

The Boston *Journal of Commerce* thus defines it: A sleeper is one who sleeps. A sleeper is that in which the sleeper sleeps. A sleeper is that on which the sleeper runs while the sleeper sleeps. Therefore, while the sleeper sleeps in the sleeper, the sleeper carries the sleeper over the sleeper under the sleeper until the sleeper which carries the sleeper jumps the sleeper and wakes the sleeper in the sleeper by striking the sleeper under the sleeper, on the sleeper, and there is no longer any sleeper sleeping in the sleeper on the sleeper.

© 1888 SCIENTIFIC AMERICAN, INC.

Correspondence.

A Steam Rocket.

To the Editor of the Scientific American:

California Gulch, one of the active centers and busy thoroughfares of the great mining camp of Leadville, was shaken to its center by an explosion, on the 9th of August, at 12:30 P.M.

It seems that some lessees on the "stone mine" had a small vertical boiler 5 feet 6 inches by 2 feet attached to a friction hoister. Steam was being raised preparatory to commencing the afternoon work, when suddenly a plate in fire box gave way, the boiler tore itself loose from the bed plate, crashed through the roof of shaft house, and, rocket-like, ascended a considerable height in the air (statements of observers vary from 300 to 600 feet) and fell 180 feet from the point of ascent. A deep dent in the boiler was evidently the effect of the fall from the great height to which it ascended.

From the construction of the boiler, it was well nigh impossible to clean out the space between the firebox and outer shell. Consequently, in using the calcareous waters of the district, this space was probably filled with lime deposit. The burnt appearance of the plates and bagging or bulges between the stays would favor this view.

Scarcely any damage was done to the shaft house except the roof. One man was sitting five feet from the boiler when it exploded. He was knocked down and bruised somewhat, but was otherwise uninjured. Several other men were in the building, and escaped without a scratch. The whole force of the explosion tended to send the boiler upward, and thus happily prevented the destruction to life and property that would otherwise have occurred. DAVID J. ARGALL.

Leadville, Colorado.

Edison's Phonograph in England.

The expectation that Mr. Edison's phonograph would soon be rendered "loud-speaking"—capable, that is to say, of communicating its message to several hearers at once without the intervention of tubes extending from the instrument to their ears—has already been abundantly fulfilled. Colonel Gouraud received a large party of visitors recently, in order to exhibit to them the second instrument which he has received from America, and which, being furnished with a sort of speaking trumpet from which its sounds issue, is distinctly audible to a large group of persons. It was accompanied by a set of cylinders carrying the traces of much talking, as well as of much vocal and instrumental music, and all these, when they were put into the machine, yielded up their record with truly marvelous fidelity. One cylinder had been impressed with the habitual noises of Mr. Edison's workshop, and the listeners were entertained by a succession of sounds produced in the first instance on an anvil, with sandpaper, by a sounding telegraph, and in various other ways too numerous to mention. Another cylinder addressed the company in Mr. Edison's name, and in his voice; while a third yielded up a song from *Faust,* and a fourth "The Barefooted Friar," the traces upon all these having been made in America. Mrs. Shaw, the lady who is widely known as "La Belle Siffleuse," was among the company, and, after she had whistled to a cylinder, the phonograph was made to reproduce her notes with astonishing accuracy, and, presumably in consequence of the more intense character of the vibrations, much more loudly than those of speech or song. —*London Times.*

A Large Clock.

A new clock, weighing 2½ tons, has just been placed in the tower of the Glasgow University, similar to the great clock at Westminster. The frame of the clock newly erected is horizontal and of cast iron planed. It is 6½ feet long, 2 feet wide, and 1½ feet in depth. It is supported on beams built into the wall of the tower, so as to obviate vibration. The wheels, which are of gun metal, can be moved separately, as the pivot holes are screwed to the frame. The main wheels of the striking and quarter trains are 20 inches in diameter, and attached to them are cams to lift the hammers, which are fixed in iron frames connected with the clock by cranks, and having a check spring to prevent vibration. The weight of the hammer that strikes the hour is 120 pounds, and it is lifted 10 inches. There is an automatic apparatus attached to the clock, which stops the quarter peals at night and starts them in the morning. The escapement of the going part is known as the double three-legged gravity, invented by Lord Grimthorpe. The pendulum is of zinc and iron, to counteract influences of temperature. The tubes are arranged so that the expansion of one raises the center of gravity, while that of the other lowers it. The bob of the pendulum is cylindrical, and weighs 3 cwt., and the beat is 1½ seconds. The "bolt and shutter" appliance of the nobleman already named maintains the motion while the clock is being wound. Messrs. J. B. Joyce & Co., Whitechurch, Shropshire, manufactured the clock.—*Engineering.*

Feathered Artists.

BY JOHN R. CORYELL.

In looking for the artists among the birds, one would hardly think of going to the crows to find them, and yet it is among the crows that the feathered artists are most common. The Baltimore oriole, for example, which shows a plain love of the beautiful by weaving into its nests as many bright colors as it can, is a cousin of the crow and should properly be called a starling. Give the oriole a choice of building materials, and repeated experiment has shown that it will always select the brightest colors.

But the most famous artists of the crow family are the bower birds of Australia. And among the bower birds the spotted collar bird is the most artistic. It builds but an ordinary nest for the laying of its eggs and the rearing of its family in, but to compensate for the lack of taste displayed there, it exerts itself like the ideal socialist to apply its talents for the general good. Ordinarily in the bird world the female is the architect, but with the bower bird this is not the case. The male birds at certain seasons of the year come together with as much system as the beavers when building their dams, and unite for the erection of what have been aptly called assembly rooms. In shape these structures are bower-like; hence the name given the bird. In purpose they are literally for the assembling of the two sexes at pairing time, when every male bird in his best plumage attends and disports himself in the way which to him seems best calculated to win him the object of his affections. The male birds having given their time and talents to the building, think perhaps that they have the best right to the privileges of the place. However that may be, they certainly do most of the promenading and dancing. They actually do dance, seeming, moreover, to enjoy the exercise. They are not so selfish, however, as to exclude the females from the delights of this pastime, but permit them to dance as much as they choose, only observing the decorous rule of dancing singly instead of in pairs of opposite sexes.

A remarkable degree of ingenuity and skill are displayed in the building of the bower. A flooring of about two feet by three is first woven of twigs. Other twigs of a curved shape are disposed along the length of this platform in such a way that the tops meet in an arch over it. These are held firmly in place by being inserted in the ground and by having stones laid all along their bases. If these twigs forming the sides of the bower are found to have projecting twigs on them, they are removed and others are put in their places, for nothing is permitted in the bower that is at all likely to injure the plumage of the festive birds. Other twigs are woven laterally into these twigs to give the structure greater strength, and the inside of it is lined with tall, soft grass, so disposed that the tufted heads meet near the roof. The grass is kept in place by a row of stones arranged along the inner base of the bower. The structure being completed, the birds go out upon a search for objects with which to ornament not only the bower itself, but the approaches to it as well, for the entrances to the structure are marked by well defined pathways lined by small white pebbles in the manner of some of our country garden walks. The ornamental objects sought are required to be either pure white in color or brilliant or glittering. Bleached bones, bright seeds, gay shells, feathers, agate, and the like substances are most commonly employed. In front of each entrance a little mound covered with ornamental objects is placed.

In Africa there is a bird which, like the bower bird, combines the qualities of architect and decorative artist, with the difference that this bird divides the talents between the sexes, the female being the architect and the male the decorator. The house, for such it really is, is a notable affair, consisting of mud and twigs, and covering an area of fifty square feet in some instances. One observer has described this extraordinary structure in these words: "The doorway to this dwelling is placed on the lower part of the slope, in order that rain may not cause an inundation of the habitation. A level platform of wood is then built at the higher end of the structure, and a carpet of some soft vegetable material is laid on it. A partition wall with a doorway is then raised to cut this portion off from the main room, for this is the mother's chamber and the nursery. Another portion of the dwelling is then partitioned off for use as a storeroom, and it is the male bird's duty to stock it with provisions against a bad season. The remaining space in the house is retained by the male bird as a sort of guard house and resting place combined."

No sort of decoration is allowed by the mother bird to encumber the interior of the house, but apparently she does not care what the father does with the outside, provided only that he first procures food before giving himself up to his artistic instincts. The things which he collects show his catholic taste in art. Anything glittering or odd in shape will please him, and, if the truth be told, his house in the end comes to look like a refuse heap or a modified city dumping ground. The passion of the hammerhead for *objets de vertu* is such, and so well understood among the natives, that when one of them loses any specially glittering or gaudy article, he at once sets out for the nearest hammerhead house and there searches for it.

In a certain sense the gardener bird of New Guinea is more remarkable than either of the foregoing birds. It is not a well-known bird, and most of what we know of it is derived from the account of an Italian naturalist, Dr. Bessari, who had heard of it from the natives, but would not believe what he was told until he had verified their words by actual observation of his own. It is a sober-colored little bird, and, like the bower bird, does not devote any of its artistic tastes to the beautifying of its own home, which is as simple as the circumstances of a nest in that region will allow.

It is on the public assembly room that it exercises all its strange powers. When the time for building has come, a level spot, upon which a stout, upright shrub is growing, is selected, and all around the shrub, as around a tent pole, the edifice is erected. The apex of the tent is about twenty inches from the ground, and the base is nearly a yard in diameter. The sides are formed of stems tightly interwoven until a waterproof material is made. An arched doorway is made in the most convenient side, and a gallery is constructed all around the interior of the building. An embankment of moss holds the central pillar firmly in its place.

But it is on the grounds that the artistic feeling of the bird shows itself, and these are thus described: "The grounds cover about the same space as the house, and are made green and lawn-like by being covered with patches of moss brought thither for that purpose. Over the lawn are placed in artistic manner bright flowers, fruits, and fungi. Insects, too, which are attractive by reason of brilliant coloring, are captured and disposed about the grounds. Nor is this all; the inner gallery is also decorated with these bright objects. And when the ornamental fruits, flowers, and insects begin to fade, they are removed and replaced. Moreover, with evident design, the material of which the house is built is a species of orchid which retains its freshness for a very long time."

Besides these birds, there are many others which in one way or another exhibit real artistic feeling. The baya bird of Asia, for example, decorates its nest, itself an elaborate structure, with fireflies, which, in the night, give out their brilliancy, much as our houses when, on the occasion of a garden party, we hang them about with Chinese lanterns. The humming bird, too, shows a distinctly decorative sentiment when it covers the outside of its nest with gayly colored mosses and lichens.

Mahogany the Best Finishing Wood.

As is known to every woodworker, mahogany has no equal for durability, brilliancy, and intrinsic value for any work which requires nicety of detail and elegance of finish. Cherry, which is a pretty wood for effect and extremely pleasing when first finished, soon grows dull and grimy-looking. Oak, which has been so much used of late, is attractive when first finished, but experience teaches that it does not take many months to change all this, and instead of a light, fresh-looking interior, one that has a dusty appearance is presented, which no amount of scraping and refinishing will restore to its original beauty. What applies to oak is yet more applicable to ash.

Mahogany, however, seems to thrive best under the conditions which are detrimental to these other woods. At first of a light tone, it grows deeper and more beautiful in color with age, and although its first cost is more than these other woods, yet its price is much less than is popularly supposed, and the only objection urged against it has been cost. What is more valuable, however, and what makes mahogany in reality a less costly wood, is the fact that, unlike cherry, oak or ash, it is easily cleaned, because it is impervious to dust or dirt, while it does not show wear, and instead of growing duller, grows brighter and more pleasing in appearance. While first cost is more than that of cherry, oak or ash, it is nevertheless true that the judgment of many men has led them to regard mahogany as the cheaper wood when its durability and cleanly qualities are considered, and to-day it takes front rank in first class material.—*The Builder and Woodworker.*

Adhesive Qualities of Onions.

Paper pasted, gummed, or glued on to metal, especially if it has a bright surface, usually comes off on the slightest provocation, leaving the adhesive material on the back of the paper, with a surface bright and slippery as ice. The cheaper description of clock dials are printed on paper and then stuck on zinc, but for years the difficulty was to get the paper and metal to adhere. It is, however, said to be now overcome by dipping the metal into a strong and hot solution of washing soda, afterward scrubbing perfectly dry with a clean rag. Onion juice is then applied to the surface of the metal, and the label pasted and fixed in the ordinary way. It is said to be almost impossible to separate paper and metal thus joined. Probably metal show tablets might be successfully treated in the same manner.

© 1888 SCIENTIFIC AMERICAN, INC.

Invention and Discovery.

Two words which glibly enough fall from the lips of the average man in a careless sort of indiscrimination as if they were synonymous. But there is a vast sea of distinction between them. Literally, they are not so widely separated; but they have come to represent two totally different aspects of human action. To the writer's thinking, the terms have been greatly confused.

Columbus hardly *discovered* America, he *invented* it—that is, as to its cognizable existence. He studied, figured, applied the laws as he knew them, and determined that there must be a continent there, and he plodded on till he proved the fact, and reduced his invention to practice.

Newton *discovered* the law of gravity, one might say, without either mental or physical effort. Watt invented the steam engine, and Stephenson invented the locomotive. They felt and knew the goal was ahead, but how to reach it was the question which required invention of the highest order. Eli Whitney saw the painful and laborious methods of cleaning out cotton and shredding it, intuitively felt it could be done by machinery, went to *work*, and gave the world one of his great inventions, the cotton gin. Howe's great inspiration to place the eye at the point of a needle may be said to have been a discovery. It unfolded a picture to his mind prophetic of good to almost countless millions, but *invention* had to be invoked to give the picture life, and the sewing machine, in all its beauty, came slowly forth from the chrysalis of Howe's discovery. The irregular lathe and the modern harvester were inventions; their dim, indefinable forms loomed up in the mists of their inventors' minds, they felt the impulse of improvement, the value of the goal gained, and they went to work and at last succeeded, and the wood carver and reaping hook lost their usefulness to that extent.

The electric telegraph was never discovered; it was consistently invented. Countless devices and methods were designed, tested, thrown away—to be afterward revivified, many of them—new appliances and systems laboriously worked out, the midnight oil unsparingly sacrificed, until at last a perfected and practical system and apparatus were given to the world.

It is hard to say whether the dynamo was invented or discovered, considering its prototype, the magneto machine. The probabilities are it was an accidental discovery. The arc light was a discovery pure and simple. Electric incandescence was a discovery, but the incandescent lamp in its commercial form stands forth as one of the most beautiful examples of man's inventive faculty. The countless experiments on material, the bulb, the seal, the standardizing, the pumps, and all the appliances that go to provide us with the beautifully glowing luminary, all are ineradicable proofs of invention of the very highest order. Midnight oil and noonday sun, morning's vigor and evening's reposeful ruminations, were all called into requisition to complete the work. This is true invention.

The phonograph was originally a discovery, a happy thought of Edison's, but invention of a high order was necessary to produce the beautiful instrument of the present day. It was like Howe's needle—the germ was there, but the machine had to be devised to make it practicable.

The undulatory telephone was a discovery, a brilliant one, but still a discovery. A happy thought supplied the missing link in an incomplete chain, and when the weld of that link was accomplished the whole world was enchained in admiration, the wonderful utility of the device was quickly recognized, and the discoverer reaped a rich harvest.

The pneumatic process of Bessemer was an invention of high grade and far-reaching importance, and the Siemens regenerative furnace has proved its equal in merit as a methodical and logical invention beautifully carried out.

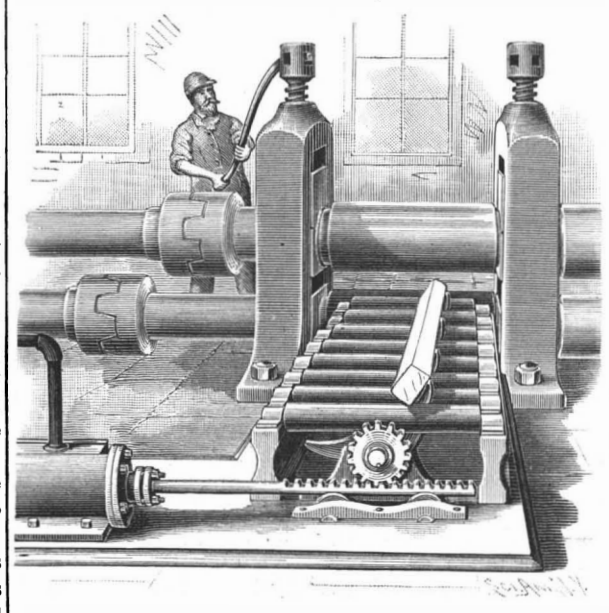
The inventor sees his goal, and consistently strives for it. He knows the object is there, and he goes energetically after it, sometimes straight to it, but oftener is many times lost in the wilderness of deluded fancy. He sees a light ahead, sighs relief and darts after it, only to find it a will-o'-the-wisp. Undaunted, he starts again, only perhaps to meet other and worse misfortunes. But he struggles on hopefully, and at last reaches the shrine of his adoration and is for the time content.

The discoverer walks along calmly toward some goal, or lies on the roadside meditating, and happening to cast his idle eyes downward, sees a gem sparkling at his feet, and he sometimes picks it up and adds it to the galaxy of the world's diadem, but he as often fails to note the scintillations that betoken its preciousness, and spurns it back into the deeper dust, to lie unseen and unknown perhaps for ages.

Which of these two promoters of the world's welfare merits the higher praise, it is needless to ask.—*Electrical Review.*

AN IMPROVED INGOT MANIPULATOR.

An improved apparatus to facilitate the handling of steel blooms, billets, slabs, etc., in a rolling mill, is illustrated herewith, and has been patented by Mr. Orlando P. Mason, of Bellaire, Ohio. The tables by



MASON'S INGOT MANIPULATOR.

means of which the ingot is fed to the rolls have driven rollers on which the ingot lies, and by which it is moved backward and forward as it is passed to and fro through the rolls. A horizontal shaft is arranged on bearings under the rollers, and provided with a series of projecting arms, preferably of crescent shape, at right angles to its axis, the arms extending upward between the rollers, and the shaft being operated by a pinion working into a rack actuated by a hydraulic cylinder, by a small reversing engine, or in any other suitable manner, the length of the rack being such as to allow the shaft to make one complete revolution. With this construction the ingot, as it lies on the rollers, can be readily moved from one side to the other, the crescent-shaped arms catching the piece on its lower corner and tumbling it over, as the horizontal shaft is put in motion by means of the reversing engine or other power.

For further information relative to this invention address Mr. John W. Cabot, Bellaire, Ohio.

NEW TYPE OF PHOTOGRAPHIC PORTRAITS.

Fig. 1 is the exact reproduction of a photograph. It gives a genuine portrait under the form of a marble bust. How such a result may be easily obtained is shown in Fig. 2. The model is placed behind a hollow column or thin pedestal of painted wood. If it be desired to represent a Roman emperor, a helmet of white cardboard is placed upon the model's head, his hair and face are whitened with rice powder, and those portions of the body that it is desired to render visible are surrounded with white flannel. The background should be formed of black velvet. It in nowise interferes with the operation if the arms be raised. After the negative is developed, the figure that it is desired to preserve is cut around with a penknife, and the arms and all the portions that are not wanted are scratched out. The glass thus becomes transparent where the scratching has been done, and in the positive the bust stands out from a black background.—*La Nature.*

Fig. 1.—A PHOTO BUST.

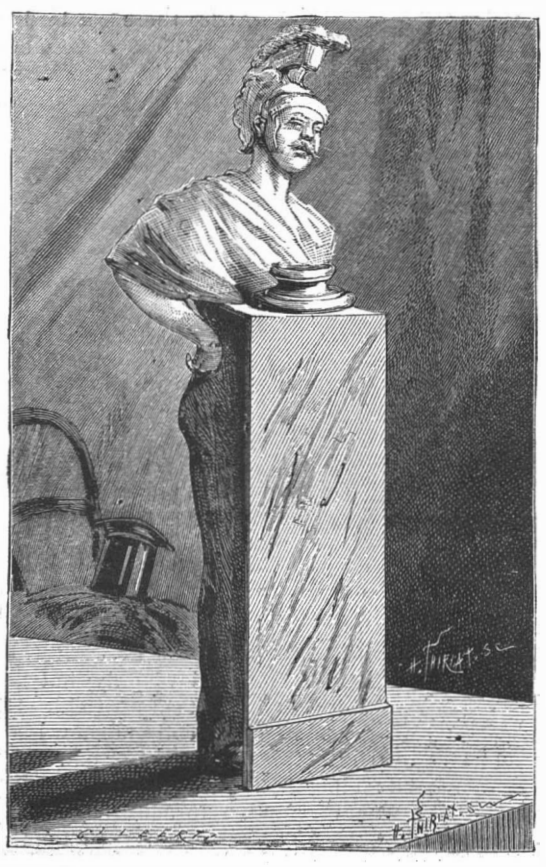


Fig. 2.—HOW THE BUST IS OBTAINED.

Electrical Street Railways.

"The Solution of the Municipal Rapid Transit Problem" was the subject of a paper recently read before the American Institute of Electrical Engineers by Frank J. Sprague. The actual operation of street railroads by electricity is bringing to view the obstacles which are to be overcome, and the success already attained leads Mr. Sprague to believe that municipal rapid transit is to be solved by the adoption of some system of electrical propulsion. It is his opinion that the data and experience obtained in the operation of the Union Passenger Railway in Richmond, Va., prove that electricity meets all the requirements for traffic of that character, while the grades are heavier and the curves sharper than will be encountered in most American cities. The Richmond road aggregates thirteen miles of track through nine miles of streets, and is operated from a central station, the power being derived from three 125-horse power engines. The cost of running the cars is $1.98 for operating and $1.48 for station expenses—a total of $3.46 per car per day or eighty-mile run. This does not include executive expenses, taxes, nor general charges of that character. The overhead system he considered the best and most economical, and, if properly constructed, has no objectionable features. For the operation of a similar surface railroad in New York City, conductors could be advantageously suspended underneath the elevated railroad structure.

The Fortifications of the Future.

General Brialmont, Inspector-General of Belgian Fortifications, says the defenses of the Meuse are the material guarantee of Belgian neutrality and autonomy, and constitute a line of defense for France. The valley of the Meuse is continued in France by the valley of the Oise, which is not sufficiently defended. The twenty-one forts which are being constructed in Belgium, and which are capable of offering effectual resistance, are a barrier closing at the same time the gates of Belgium and those of France. Thirty months will suffice for their construction, which has been undertaken by competent French contractors. The system adopted is that of metallic cupolas. Metallic cupolas will be the fortifications of the future. The common belief that the power of explosives may be indefinitely developed is, says the general, contrary to facts. All recently invented explosives are of nearly the same value. There is no reason to believe that greater destructive force can be obtained by means of explosives. The steel cannon hooped with iron represents also the maximum of resistance which can be obtained from the tube conveying the explosives. The problem of defense is thus simplified, as the projectiles which can be directed against the metallic cupolas have arrived at the highest possible degree of power. The metallic cupolas resist the most powerful cannon, and the ripping of some cupolas during the recent trials at Chalons does not prove the contrary, because no work can withstand a protracted fire at only 200 meters distance. In regular war there is no firing at 200 meters. Germany is erecting metallic cupolas in her fortresses, while France is only discussing the matter, and has virtually no longer a fortified frontier on the east.

Dangers of the Emery Wheel.

By the bursting of an emery wheel in the carriage factory of R. M. Stivers, in East Thirty-first Street, this city, Henry Dunwald, a young grinder, was killed. He was bending over the wheel, and some of the flying fragments crushed in his chest. Dunwald was twenty-two years of age and unmarried. He had selected the wheel as one without a flaw, and he had sole charge of it in the factory.

© 1888 SCIENTIFIC AMERICAN, INC.

THE MACHINERY OF THE INMAN LINER CITY OF NEW YORK.

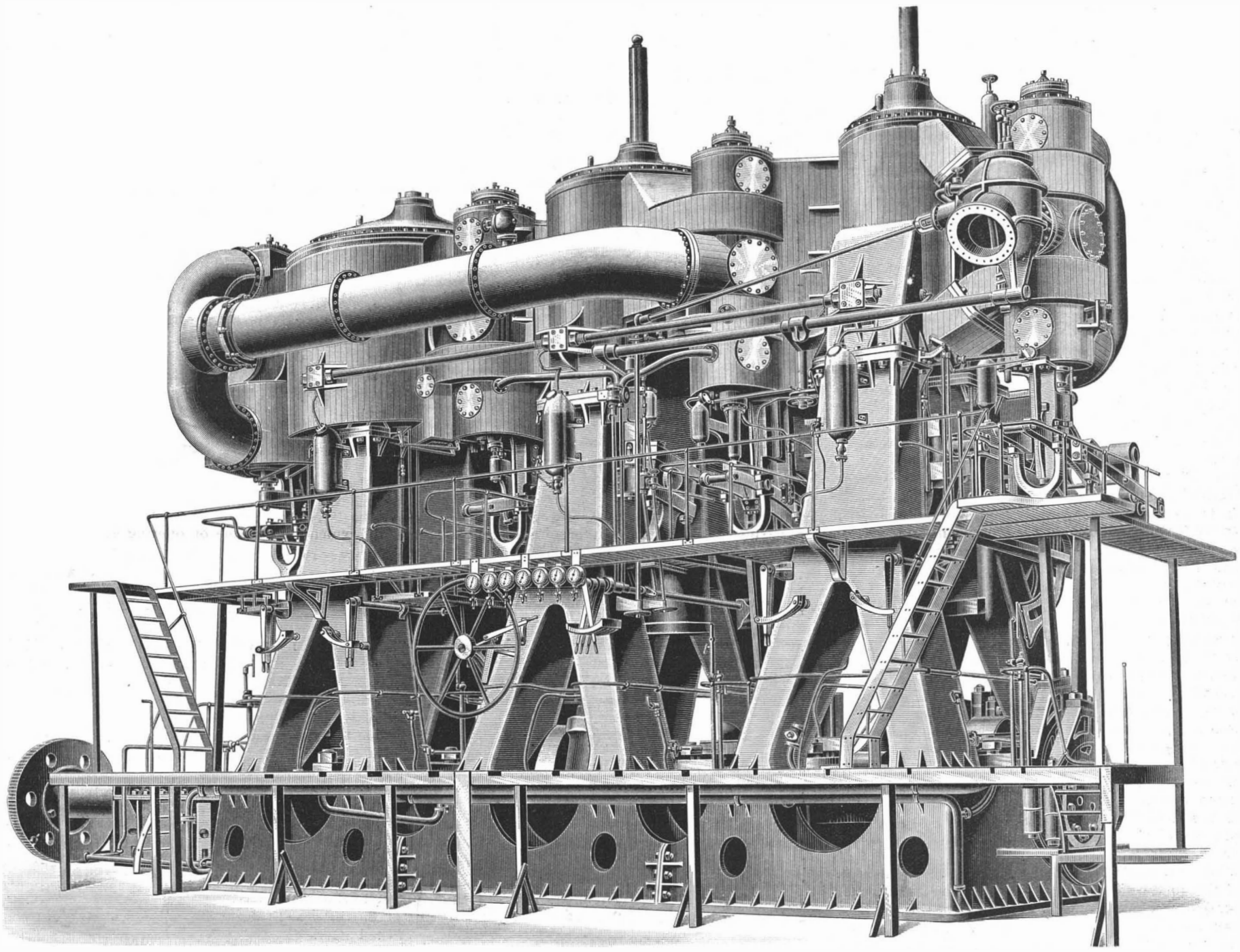
This new and magnificent steamship has lately completed her first round trip from Liverpool to New York and back, and a fair trial of her ponderous machinery has been had. The results show that the calculations of the builders were correct. The working of the mechanism proved highly satisfactory. We take the following from *Engineering*, together with our engraving:

The twin screw steamer City of New York was built and engined by Messrs. James & George Thomson, Clydebank, to the order of the Inman and International Steamship Company. The many novel features of the hull are accompanied by almost as many novelties in the machinery. The adoption of the principle of twin screws has been almost compulsory in this case, as it would be very difficult and probably very imprudent to construct single screw engines having the enormous power that these combined twin screw engines are intended to exert. The great advantage of built upon a very solid structure in the ship, but have, in addition, a cast steel bed plate. This bed plate is formed in three parts, each part weighing about sixteen tons. The columns are also of cast steel, and are of the "split type." The condensers, which usually form part of the main engine structure, are made, as in war ships, of brass, and are quite independent. The cylinders and their covers are cast iron, but the pistons are of cast steel of the dished type. The crankshafts are built of steel; the thrust, tunnel, and propeller shafts are also of steel. The crankshaft is 20¼ in. in diameter at the journal and 21 in. at the pin. The tunnel shafting is 19¼ in., and the propeller shafting 20¼ in. The piston rods and all the principal moving parts are of ingot steel. The piston rods have tail rods, and are attached to the pistons by flanged connections.

The high, intermediate, and low pressure cylinders are 45 in., 71 in., and 113 in. in diameter respectively, the stroke being 60 in. All the valves are piston valves, being one on the high, two on the intermediate, and four on the low pressure cylinders. The adoption of

The air pumps are the only auxiliaries driven from the main engine. There are two of them to each engine, of the ordinary vertical type, and they are worked by levers off the high pressure and low pressure crossheads. A small oil pump is also driven off the main engines. It is for keeping the crank pits clear of oil, which is forced into the stern tubes.

The boilers are fed by Worthington vertical pumps, four in number, associated with Gilmour's feed heater. These during the trial proved satisfactory, and in this connection it may not be uninteresting to indicate briefly their system. Each pump has two 12 in. steam cylinders and 28½ in. double-acting water plungers, with a 10 in. stroke. There are two pumps in each engine room. Of these one supplies the feed heater with water at the temperature of the hot well. This water has its temperature raised in the feed heater by live steam from the boiler to nearly the boiler temperature, and the second pump delivers this heated feed water at a slightly increased pressure to the boiler. There is no advantage on the score of economy; but in so far as



THE MACHINERY OF THE INMAN LINER CITY OF NEW YORK.

the duplication of all parts is too obvious to be dwelt upon here, excepting to state that with only one of the engines running, sufficient power would be developed to propel the vessel at about 15 knots per hour. To indicate how the dimensions and power of the engines of the City of New York compare with those of the principal merchant single screw steamers afloat we give a table compiled partly from a paper read by Mr. W. John, at the Liverpool meeting of the Institute of Naval Architects last year, and partly from the records of the trials of the steamers.

It will readily be seen that the power to be developed in the City of New York (20,000 indicated horse power) is considerably in excess of that in the other steamers, and to have fitted a single set of engines, even supposing it had been advisable from every other standpoint, would have been a very questionable step to take. The view we give is of the port engine. The two engines are separated by a longitudinal bulkhead reaching up to the main deck, communication being established by a sliding door, worked by a rack and pinion from above in case of need.

Many of the features which are common to war ship machinery have been introduced into the design of these engines, in order partly to save weight and in consideration of the high piston speed. The engines are the four sets of piston valves for the low pressure cylinder is unique, and is necessitated by the large port area in this cylinder, and to avoid the strains due to the great overhang which would be caused by the adoption of two sets only. The valve gear is of the ordinary eccentric type, the eccentric straps being of cast steel lined with white metal. The equilibrium valve, which controls the inlet of steam, is worked by an independent engine, which can be connected to the Dunlop governor. The adoption of this engine renders the handling of the main engine very much easier.

The turning engine is of a new type, being simply a hydraulic ram working by a pawl on a ratchet wheel. This ram is vertical, and takes up very little space, but is at the same time very powerful.

In addition to the usual draining from the jackets and casings, which is collected in the hot well, there is a continuous flow through the casings from the high pressure to the intermediate pressure casings, and from the intermediate pressure to the low pressure casing. In the latter casing the drainage passes into the low pressure cylinder in the form of vapor, there doing work, and finally passing into the condenser. By this means any accumulation of water is prevented in the casings when the engines are running, and the glands are always dry.

the feed water is introduced at boiler temperature there is complete absence of any possibility of strain due to irregular cooling of the boiler plates. The heater can be thrown out at any time and only one pump used, and as the capacity of each pump is sufficient of itself for boiler feeding, the other may be looked upon as an alternative in case of breakdown. In the ordinary arrangement, the first pump, which delivers from the hot well into the feed heater, is controlled by a float in the tank, so that it will be impossible either to have overflow or an insufficient quantity in the hot well. As all the water passing through the feed heater is at a high pressure all impurities in the water are deposited in the latter, from which they are occasionally discharged by means of a blow-off; and since the heater itself is in no way cramped or confined by large tubes, its cleaning becomes a very easy matter. Indeed, it is completely done by blowing off at regular intervals.

There are two fire and bilge pumps in each engine room for general ship purposes. These are also so arranged that they can be used as feed pumps in the event of the main getting out of order, and they are connected to the double-bottom system of piping, and are available for pumping the compartments between the bottoms should the circulating pumps be in use for other purposes. The water is circulated through each

© 1888 SCIENTIFIC AMERICAN, INC.

HULLS AND ENGINES OF ATLANTIC STEAMERS.

Name.	Vessel's Dimension.			Engines.	Engine Cylinders.		Boilers.		
	Length.	Breadth.	Moulded Draught.	Indicated Horse Power.	Diameters.	Stroke.	Heating Surface.	Area Fire grate	Working Pressure.
	ft. in.	ft. in.	ft. in.			ft. in.	in sq. ft.	in sq. ft.	lb.
SS. City of Rome	542 6	52 0	21 5½	11,890	3 in. 46 / 3 in. 86	6 0	29,286	1,398	90
" Normandie	459 4	49 11	19 9¾	6,959	3 in. 35 7/16 / 3 in. 74⅝	5 7	21,404	756	85
" Arizona	450 0	45 1½	18 9	6,300	1 in. 62 / 2 in. 90	5 6	..	..	90
" Orient	445 0	46 0	21 4½	5,433	1 in. 60 / 2 in. 85	5 0	..	..	75
" Stirling Castle	420 0	50 0	22 3	8,396	1 in. 62 / 2 in. 90	5 6	21,161	787	100
" Elbe	420 0	44 9	20 0	5,665	1 in. 60 / 2 in. 85	5 0			
" Umbria and Etruria	500 0	57 0	22 6	14,321	1 in. 71 / 2 in. 105	6 0	38,817	1,606	110
" Aurania	470 0	57 0	20 0	8,500	1 in. 68 / 2 in. 91	6 0	23,284	1,001	90
" America	432 0	51 0	26 0	7,354	1 in. 63 / 2 in. 91	5 6	22,750	882	95
" Servia	515 0	52 0	23 3½	10,300	1 in. 72 / 2 in. 100	6 6	27,483	1,014	90
" Alaska	500 0	50 0	21 0	10,500	1 in. 68 / 2 in. 100	6 0	..	..	100
" Ems	430 0	46 10	20 7½	7,251	1 in. 62 / 2 in. 86	5 0	19,700	780	100
" Aller	438 0	48 0	21 0	7,974	1 in. 44 / 1 in. 70 / 1 in. 100	6 0	22,630	799	150
" Ormuz	465 6	52 1½	..	9,000	1 in. 46 / 1 in. 73 / 1 in. 112	6 0	26,000	850	150
" Lahn	448 5	49 0	..	9,500	2 in. 32½ / 1 in. 68 / 2 in. 85	6 0	.	..	150
" City of New York	560 0	63 3	25 0	20,000	2 in. 45 / 2 in. 71 / 2 in. 113	5 0	50,265	1,293	150

of the main condensers by two sets of 15 in. centrifugal pumps, either of which is more than capable of doing all the work required. There are fresh water condensers in each engine room, which have their own feeding and circulating pumps automatically worked. All these pumps are of the Worthington type.

The hydraulic installation of the ship, which is the most extensive fitted on shipboard, has its pumping engines—two in number—in the engine room. These engines are of the compound surface condensing type of Messrs. Brown, now so well known in connection with hydraulic ship plant. These engines work seven hoists, nine derricks, two warping ends, a windlass, and two warping capstans aft on the promenade deck.

The steel boilers which supply the steam are nine in number, and are equally divided in three water-tight compartments. They are built of steel, the shell plates being $1\frac{9}{32}$ in. in thickness. The diameter of each boiler is 15 ft. 6 in., the length 19 ft., and the working pressure is 150 lb. to the square inch. The boilers are double-ended, and have each six furnaces, the mean diameter being 3 ft. 11 in. The tubes are 7 ft. 6 in. long, $2\frac{3}{8}$ in. in diameter, and in each boiler there are 1,056 tubes, or 9,504 in the nine boilers. The total heating surface is 50,040 square feet. The furnaces on each end have a common combustion chamber. Each boiler weighs seventy-four tons.

The boilers are worked on what is known as the closed stokehold system. This is the first ship for the Atlantic passenger trade that has been worked on this system, and it necessarily introduces many novelties. There are no air hatches excepting those through which the fans draw down the air supply. The fans for supplying air to the furnaces are twelve in number, and are each 66 inches in diameter. They are the result of very exhaustive experiments. The application of forced draught has become so general that the design of the engines has become equal in importance with the engine for propelling the ship. The experience which the Messrs. Thomson have gained during the past few years in constructing high speed war ships fitted with forced draught has enabled them to design a fan and engine that will work with great efficiency and comparatively no attention.

Wooden Toothpicks.

A toothpick factory, so says the *Timberman*, is one of the flourishing woodworking establishments at Harbor Springs, Mich., and it is one of the largest factories of the kind in the country. White birch is exclusively used in the manufacture of the toothpicks, and about 7,500,000 of the handy little splinters are turned out daily. The logs are sawed up into bolts each twenty-eight inches in length, then thoroughly steamed and cut up into veneer. The veneer is cut into long ribbons three inches in width, and these ribbons, eight or ten of them at a time, are run through the toothpick machinery, coming out at the other end, the perfect pieces falling into one basket, the broken pieces and the refuse falling into another. The picks are packed into boxes, 1,500 in a box, by girls, mostly comely-looking young squaws, and are then packed into cases and finally into big boxes, ready for shipment to all parts of the world. The white birch toothpicks are very neat and clean in appearance, sweet to the taste, and there is a wide market for them. The goods sell at the factory at $1.90 a case of 150,000 picks, or 100 small boxes each containing 1,500, and the small boxes retail at five cents each, or 300 picks for one cent, at which rate almost everybody can afford to take a fresh toothpick after each meal.

Hydrochinon.

Probably the most interesting of all photographic chemicals at this moment is the much debated hydrochinon, recently brought forward as the perfect developer and substitute for pyrogallic acid. In fact, Balagny, one of the most expert French photographic investigators, pronounces it absolutely satisfactory, giving strength and vigor, and defying fogging in over-exposed plates, rendering detail in shadows, and susceptible of use for continuous operations of development. It does not become discolored, and certainly does not stain gelatine emulsions.

The formula of hydrochinon is given below, with the formulas of the three other chemicals that closely resemble it in chemical composition:

Pyrogallic acid has the formula	$C_6H_3(OH)_3$
Brenzcatechin is	$C_6H_4(OH)_2$
Chinon is	$C_6H_4O_2$
Hydrochinon is	$C_6H_4(OH)_2$

Looking at the chemical components of the above named bodies, a very slight difference of composition is plainly seen, and yet the four substances are distinctly different both chemically and physically, and three of them are of photographic importance. Another form of hydrochinon described by Wohler, called green hydrochinon, contains $C_6H_5O_4$, but this form has not yet been tried in photography.

Why these substances of apparently the same composition should have such varying properties is the subject of years of hard study and theory among the hard working chemical investigators, who are continually finding new compounds and methods of utilizing them in practical pursuits.

Hydrochinon, at first simply the interesting "find" of a scientific investigation, with its properties closely studied has been utilized simply by scientific deduction as to its reducing properties, and after being known for years comes to the front, ready for the photographer and promising to be a substitute for pyrogallic acid.

Corlorless hydrochinon is the principal product in the dry distillation of kinic acid, a substance found in cinchona bark, also from the addition of hydrogen to chinon, a substance produced artificially from aniline, which was first produced by the distillation of indigo.

To prepare hydrochinon from chinon, Wohler took a hot saturated solution of chinon (with a good quantity of chinon in suspension), passed sulphurous acid gas through it until the solution was colorless or all the chinon dissolved.

From one atom chinon, two atoms of sulphurous acid, and two atoms of water, are obtained one atom of hydrochinon and two atoms of sulphuric acid ($C_6H_4O_4 + 2SO_2 + 2H_2O = C_6H_6O_4 + 2SO_3$). Evaporating this solution at a moderate temperature, hydrochinon crystallizes out, without being decomposed by the sulphuric acid which has been formed. The crystals, being collected, are washed with a small quantity of ice cold water, and by recrystallization are produced in a pure state.

These crystals occur in colorless, six-sided prisms, easily soluble in water and alcohol, and more readily when warmed. They are odorless, taste sweetish, and are neutral to litmus paper. Heated in a glass tube they melt at low temperature, and then sublime on the sides of the glass, and on cooling appear in crystalline form. Between two watch glasses, on heating, they are sublimed and settle on the upper glass in shining plate-like crystals; but by higher heat they are decomposed into chinon and green hydrochinon. In solution hydrochinon is colored by ammonia, from the surface downward to a brown red color, and on evaporating this solution a brown amorphous substance results.

From an aqueous solution of hydrochinon, chloride of iron, chlorine, nitric acid, nitrate of silver, and chromate of potash precipitate a substance call chinhydron.

An alkaline solution of hydrochinon is decomposed by exposure to air. According to this reaction, it will not probably be advisable to attempt to make a "one solution" developer.

The various photographic stock solutions of hydrochinon suggested by writers invariably contain sulphite of soda in their admixture, and this doubtless is added to preserve the solution as well as for the chemical action of the sulphite of soda. Just what the decomposition is that occurs in the application of hydrochinon developer to gelatine-bromide surfaces is out of the province of this article, but it would be an interesting investigation to follow up, and its pursuit might lead to unexpected results. To those photographers who have not tried hydrochinon a new source of surprise and pleasure is at hand, and once having tried it doubtless they will discard pyrogallic acid and neutral oxalate on gelatine work. In wet plate work nothing can exceed the old methods in skillful hands, but the preparation of collodion emulsion and the use of nitrate of silver baths are tedious and treacherous undertakings, and in the extreme majority of cases of modern workers are practically abandoned for obvious reasons.

In purchasing hydrochinon, great differences will be noticed in the preparations of different manufacturers, and, so far as known, preference should be given to the soft crystalline kind, it being more readily soluble and probably purer than that in hard rhombic crystals of yellowish color. Hydrochinon is now produced in the American factories, and should the duty be maintained will be made in quantities, pyrogallic acid being imported from Europe, the absence of protection in the way of duty rendering it a losing business in competition with cheaper solvents and labor in Continental laboratories.—*Science of Photography.*

Gleanings from Various Sources.

The American Graphophone Company has decided to locate permanently in Bridgeport, Conn., and is making the necessary alterations and additions to the fine buildings formerly occupied by the Howe Machine Company. They have one of the finest properties in Connecticut for manufacturing purposes, and are putting in the special machinery and apparatus required to produce the graphophone.

A man consulted two doctors. One told him to drink nothing between meals. The other forbade him to drink anything at meal times. He paid both for advice, but it rather weakened his confidence in doctors.

Butter contracts during cold weather, forcing the brine to the surface, and the water, evaporating, leaves the salt that was in the brine in flakes on the outside of the butter.

Some men are naturally good milkers. They have a firm yet gentle hand and a way of winning the cow's confidence.

Shade sheds should be provided in treeless pastures for the cattle.

The surplus and inferior grapes make capital vinegar.

What goes to waste in many kinds of business is far more than what goes to profit.

Frogs' legs have become a staple delicacy on the bill of fare of all our first-class hotels and restaurants.

The best recipe for going through life in a commendable way is to feel that everybody, no matter how rich or how poor, needs all the kindness they can get from others in the world.

Mignonette and other plants will live for many years if the flowers are plucked as fast as they fade, but if the seed is allowed to perfect, they are but annuals—the plant dies.

The annual value of the dairy product of Illinois equals the gold production of the United States. Who says the cow is not the best friend of the farmer?

A dozen trees planted each year may change the appearance of a farm greatly in a generation and lead along to income, very satisfactory, as well.

The Brush Electric Company, Cleveland, O., reports that its carbon business is larger than ever before. It has shipped, within the last month or two, eight or ten solid car loads of carbons to different portions of the country.

© 1888 SCIENTIFIC AMERICAN, INC.

Hemlock Lumber and Bark.

Of the sole leather made in the United States, a very large proportion is tanned in the State of Pennsylvania. Jackson S. Schultz, of New York, has been for many years largely interested in this and in the lumber business, and in the manufacture of bark extract for tanning, and he writes to the *Shoe and Leather Reporter* as follows touching the uses of hemlock lumber and how long the supply is likely to last:

Hemlock lumber is worth at the mills, when in a seasoned condition, from $6.50 to $7.50 per thousand feet. This lumber is used very extensively in all parts of Pennsylvania. In the city of Philadelphia, especially, the best frames are made from this timber, and have been so made from our earliest history. This circumstance is mentioned only to show that hemlock lumber is unexceptionally good. If used for docks under water, this timber will last an indefinite time; and if used for docks and cribbing, partly under and partly out of water, it will last as long as pine or spruce. Like all other timber, if exposed to wet and dry atmosphere alternately, where so exposed it will decay. The life of hemlock, under these conditions, is not beyond eight or ten years. But the Sunbury and Erie Railroad, which was constructed about eighteen years ago, used "sapling" hemlock very largely for its ties, and many of them still remain in the roadbed. Because this wood does not hold the spikes as well as oak and chestnut in part accounts for its non-use in modern railroads. For this reason, too, are pine and spruce rejected. It is claimed that, when this wood is kyanized with tannin, it will last as long as oak or chestnut for bridges or ties.

As a finishing wood for ceilings and flooring, hemlock is subject to this objection: It will splinter when roughly used, as in kitchen floors, but when covered with carpeting on bed rooms or parlors, it will give perfect satisfaction. Many of the best hotels and dwellings of Philadelphia and Baltimore, as well as other cities of our Central States, are floored with white hemlock flooring, and it gives general satisfaction. For "siding," when covered with paint, it answers a good purpose. When not so covered, it is unsuited, as, indeed, few woods are capable of standing our climate unprotected with paint.

Wherever hemlock is used in contrast with spruce or pine in dry structures, such as dwellings, barns, sheds, etc., it will be found in all respects as lasting as these woods, and by reason of the exemption of this wood from *black knots*, it "cuts up" to a much better advantage—that is, less waste—than either of these more pretentious and expensive woods. It is to-day the wood, in most cases, men use in all the Northern States, including Canada. Until within a short period, hemlock has not been considered suitable for "pulping," but recent experiments have demonstrated that hemlock will make good pulp for the paper makers. While it is claimed that the percentage of product is not as large as from some other woods, the quality is equally as good. Recently a sample of hemlock was taken to France, and the chemist and pulp maker has sent back, as the result of his experiment, a sample of pulp quite equal to the best that is made.

Hemlock bark is conceded the leading tanning bark of the country. It is usually worth from $5 to $6 per cord, or ton of 2,200 lb., at the nearest place of delivery, when taken from the tree. When shipped to great distances by rail it is worth the freight additional, as, for instance, at Boston and Chicago it sells from $8 to $9 per ton, or cord.

The hemlock tree does not reproduce itself. When the land is once cleared of these trees, beech, birch, maple, and chestnut come in their place. This fact has given rise to the frequently expressed opinion that very soon we must look to other sources for our tanning material. Of course, under these circumstances, it is safe to predict at *some future period* there will be no supply of hemlock bark for tanners. But when asked to say how long the supply will last at the rate we are now consuming it, it is safe to say that the child is not born that will see the end of the supply.

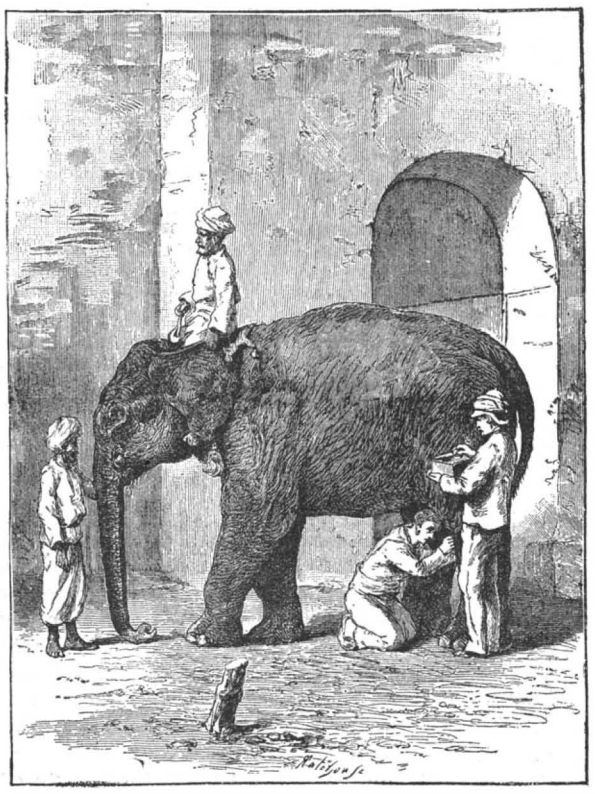
The counties of Elk, McKean, Sullivan, Warren, and Forest are substantially intact, although some forty large tanneries have been making drafts on their bark supply for sixteen years at the rate of 200,000 cords or tons per year. Except along the lines of railroads which have penetrated these counties, the hemlock forests stand to-day as they did at the beginning—covered with a dense growth of hemlock trees that will yield from 10 to 12 cords or tons per acre. When these counties were first opened up by railroads, the projectors of these roads went there for coal, but at that early day a tanner predicted that the roads built and to be built would carry out more tonnage of lumber, bark, and leather than coal. In other words, the surface would yield more tonnage than the mines. This would have been true but for the subsequent discovery of petroleum. Although that whole section is underlaid by a deposit of bituminous coal which is practically inexhaustible, the tonnage of crude petroleum, if all carried by rail, would probably far exceed all other commodities.

The final extinction of the hemlock forests will, of course, present a fruitful theme of speculation, for, as stated, it does not reproduce itself; but when we consider that other States besides Pennsylvania can be relied upon for a considerable amount of this lumber and bark, it seems quite unnecessary for us to make ourselves unhappy over the problem of final extinction.

Besides, within a few years it has been discovered that each oak and chestnut tree will yield as much tannin in its wood as its bark. This is a French discovery, and is now making practical headway in this country. If this discovery proves reliable, as there seems no doubt it will, then we may fall back on the old ground which the tanners have gone over fifty years ago, and rebuild our tanneries in the old States of New England and New York, and make leather quite independent of hemlock. But what shall we do for the serviceable and cheap hemlock lumber? Iron will take its place, as indeed it is already doing in some measure.

INOCULATING AN ELEPHANT.

Among the recent valuable discoveries of the famous French physician, M. Pasteur, is that of the vaccination of domestic animals for the prevention of the dire disease known as anthrax, or splenic fever. The marked success attending his system, in combating the rinderpest in Europe, encouraged Mr. J. H. Lamprey



INOCULATING AN ELEPHANT.

to bring the subject under the notice of the government of India, where no efficient remedy was known for this rapidly fatal illness, which annually carries off a large percentage of cattle of every kind. An order in council has been issued, after the most careful investigation of the merits of the system and of the probability of securing its favorable reception by native proprietors. In order to carry out this object, some native Indian students, who have received their education at the Cirencester Agricultural College, are now undergoing a course of instruction at the Paris laboratory of M. Pasteur, and will shortly proceed to stations in India, to dispense the vaccine, which is applied to elephants as well as to oxen and other beasts. It is confidently expected that their labors will be attended with the same success that followed the introduction of the system into those countries where it is now in full operation, with an ultimate prospect of the total extermination of the most serious maladies, working great havoc among flocks and herds throughout the world. The elephant, in a domesticated state, is liable, as well as other animals in the service of man, to certain epidemic diseases.—*Illustrated London News.*

Creosoting of Wharf Piles.

Engineer Manson's report to the harbor commissioners on the creosoting plant in San Diego and Ballona, Cal., states that the San Diego works, which were first inspected, have been in constant operation for the past six years, with the exception of a time when fire partially destroyed them in 1887. The works are located on the east shore of San Diego bay, near National City, and are accessible by rail. They cover an area of 1,000×250 feet. The plant consists of one pressure cylinder, 75×44, of 7-16 iron; two Blake air pumps, steam cylinder, 10×18; air cylinder, 12×18; three pressure pump cylinders, 8×14; one press, 5×14 feet; 75 tubular boiler and hoisting engines, pipe connections, iron trunks, etc.; storage tank, 75×4×3, 6,800 gallons.

The capacity of the plant is sixteen seventy-five foot piles each twenty-four hours. The working force is two foremen, two engineers, two firemen, and twelve laborers. The consumption of the creosote is for 3,318 feet of piling 3,169 gallons of creosote, or about nine-tenths of a gallon to each linear foot.

The cost of creosote delivered at 14c. a gallon, including labor, is 18⅛ c. a linear foot.

This does not include the cost of loading or shipping, but includes handling in the yard. A second batch cost as follows: Landing 100 piles from deep water to the beach, four men half a day, $4; fourteen men full day, $28; labor to engineer and fireman, $5; seven days' creosoting, fourteen charges night and day, $168; rafting to deep water, $8; 4,000 gallons creosote, at 14 cents, $560; total, $773, or $7.73 a pile, or 19½ cents per linear foot. The piling costs, delivered at San Diego, 26 cents per linear foot. These figures do not include interest or cost of fuel, which would amount to about one-half a cent more per linear foot.

The National City wharf was rebuilt in 1883 of creosoted piles. It consists of round piles, 12×12 feet piles, and 3×4 feet braces. The penetration of the creosote at this plant is from ¼ to 1¾. The square piling is generally in bad condition, but the round piles are in good form. The shrinkage in these piles was generally due to a split in driving the pile, injury of the piles after being driven, and imperfect and slight impregnation. In many instances the inside of a pile had been hollowed out by rot, while a shell of creosoted material was left untouched.

San Diego bay is not infested by the teredo as much as is the bay of San Francisco, but the limnoria is here, and much more destructive.

There was no indication that any of the piles at San Diego had been attacked by the teredo in National City wharf.

The oil used for creosote can be obtained at St. Louis at 7 cents a gallon, the freight to this city being 7 cents. It is a mixture of tar. Mr. Manson recommends that a sample of this oil be analyzed to fully determine its quality.

The amount of creosote oil used in the two cases cited is less than long practice has determined to be best. The results are, however, reported very satisfactory. The works are being operated night and day. These works are small and the machinery used is not of the best. Cheaper work and a more thorough penetration of creosote can be obtained. The oil can be laid down in bulk in this city at 10 cents a gallon. The cost of the San Diego works has been $12,000. The works could be duplicated in San Francisco for $5,000 or $6,000.

The Ballona plant cost $16,000, and is located near Santa Monica, Los Angeles County. The works have not yet been in operation very long, so that no data as to cost, etc., can be procured, but the better machinery at this plant lessens the consumption of creosote surprisingly.—*Pacific Lumberman.*

Coppered Carbons.

Probably nearly every electric arc lighting company owning a system (?) now electroplates its carbons. There was, in the dark ages of 1879, an interference in our much abused patent office between the two well-known inventors, Charles F. Brush and Moses G. Farmer, in relation to the coppering of electric light carbons, and it was held by Paine, commissioner, that Farmer had invented the process in controversy before Brush, but had also abandoned it, so that while priority was therefore awarded to Brush *pro forma*, the invention was thrown open to the public by Farmer's prior invention and failure to patent.

But as a matter of fact Jablochkoff had, as early as 1876, plated the carbons of his candles with copper; and though the invention had prior to that time been patented in France by Reynier, Jablochkoff disdained to recognize the Reynier patent, depending upon prior patents and publications; and it appears that Jablochkoff was right, since the Reynier patent was subsequently voided by the French courts, and held to be anticipated by a prior Carré patent and by Van Malderen's work in 1868. Bouliguine and Tchikoleff, also in Russia, plated their carbons, and published accounts of their practice.

The history of this feature of electric lighting is closely paralleled by many other features; and all other branches of applied electricity likewise disclose similar instances of anticipation. Electric lighting, however, is so old an art in itself, although commercially young, that inventors in this field cannot go far without running foul of something which had been invented (though very likely not much employed) years before.

And they acquire a decided impression, which they may voice, as others have done before them, in the complaint that "the people of *former times* had little honesty, they have stolen all my inventions."—*Electrical Engineer.*

Spectrum of "R" Cygnis.

A cable message has been received from Lord Crawford, at Dunecht, Scotland, saying that on August 13 and 22 the variable star "R" Cygnis was observed by Espin at Walsingham, and that the spectrum was found to contain bright lines. The observation was confirmed at the Dunecht Observatory.

© 1888 SCIENTIFIC AMERICAN, INC.

ENGINEERING INVENTIONS.

A cable grip for traction railways has been patented by Mr. Orlando H. Jadwin, of New York City. It has a laterally projecting counterbalance, and means for securing to the grip perfect flexibility in all directions, so as to reduce cramping and binding strains and adapt the parts to a free and easy motion through the varying conditions and positions of use.

A switch for tracks for carrying iron has been patented by Mr. Edwin A. Kern, of Girard, Ohio. It is designed for use in rolling mills, etc., where a number of side tracks join the main track, and is a vertically tilting switch pivoted at a point higher than the main track, but adapted to be lowered to rest upon the main track and held in place thereon when in use.

A rotary engine has been patented by Mr. Joseph E. Beauchemin, of Sorel, Quebec, Canada. It has a series of cylinders secured radially on a hub which forms a valve seat, with ports and an exhaust chamber, the ports leading into the cylinders, in which pistons having central openings operate on the rim of a wheel held eccentrically to the hub, the engine being adapted to be operated by water, air, or steam.

AGRICULTURAL INVENTIONS.

A harvester guard renovator has been patented by Mr. George W. East, of Heltonville, Ind. It is for sharpening worn-out or dulled harvesting or mowing machine guard fingers, and comprises a swage, a steel re-enforcing anvil plate, and a truing up gauge, whereby the work can be quickly, easily, and thoroughly accomplished.

Cultivating harrow teeth form the subject of a patent issued to Mr. Charles C. Crumb, of Burlingame, Kansas. The teeth are to be made lighter or heavier, according to the style of the cultivator or harrow, but they are of novel form, designed to work easily and be practically self-cleaning, to promote light draught of the implement, and so it will not clog easily.

A hay press has been patented by Mr. William A. Laidlaw, of Cherokee, Kansas. This invention is an improvement in that class of presses known as continuous, and whose followers are operated by a reversible sweep that allows them to be thrown back by the rebound of the hay or other material being pressed, after reaching the limit of the forward movement.

A check row planter has been patented by Mr. John Clark, of Sheffield, Iowa. It is for planting corn or other seed in accurate rows, and may be made with one or two or more feeds to plant different rows of hills, two rows of hills being preferred, the draught being very light, and the machine being designed to be operated successfully by one horse in well prepared ground.

A band cutter and feeder for thrashing machines has been patented by Mr. John H. Spurgin, of Carthage, Mo. Combined with endless horizontal slat belts is a vertical partition held between the belts, a second set of endless slat belts being held above, passing over a swinging table, on the under side of which fixed knives are held at each side of the partition, pushing prongs or fingers being secured to the ends of the slats of the central slat belt, with other novel features, the invention being an improvement on a former patented invention of the same inventor.

MISCELLANEOUS INVENTIONS.

A carpenter's rule has been patented by Mr. Michael H. Walsh, of Boston, Mass. This invention covers a novel construction, making a rule which may be used as a bevel or square as well as a rule, in which the legs may be adjustably clamped in any desired position.

A nose guard for eyeglasses has been patented by Mr. George H. Emerson, of Bucksport, Me. A nose piece is adjustably secured upon arms which project from the opposing edges of the glass frame, the adjustment being simply, conveniently, and readily made.

A running gear for vehicles has been patented by Mr. Adam Bock, of Murfreesborough, Tenn. This invention relates to an improvement in front platform carriage gear, in which it is designed to simplify the construction, and provide a light, durable, and conveniently applied device.

A horseshoeing rack has been patented by Mr. Samuel M. Martin, of Sidney, Ohio. It consists of a pen that is readily adjustable to the size of any animal, and in which the animal can readily be securely fastened, the rack being such that it can be readily taken down and removed out of the way.

A snare tightener for drums has been patented by Mr. John H. Buckbee, of New York City. It consists of snare clamping jaws mounted on guide rods on the side of the drum in such way that by turning a thumb screw in one direction the snares are tightened, while a reverse movement loosens them.

An oil filter has been patented by Mr. George W. Gallaway, of Rye, N. Y. It consists of a can with a partition, and having one or more overflow pipes, in combination with one or more filtering pans mounted above the partition, for filtering waste oil such as drips from bearings, etc.

A tobacco frame has been patented by Mr. Joseph F. Drury, of St. Vincent, Ky. It is for carrying tobacco in leaf form in a suspended or unpacked condition, the invention covering a novel construction of rack upon which the tobacco can be readily placed, or from which it can be conveniently removed.

A precautionary device for poison bottles has been patented by Mr. Frank H. Nutter, of Minneapolis, Minn. Combined with a stopper is a plate having pricking points on its outer face and a fastener on its under face to secure it to the stopper, so that when bottles in which it is used are thoughtlessly grasped the points will prick the fingers.

A portable tea and coffee pot has been patented by Emma E. C. Thompson, of Chicago, Ill. It has an upper and a lower communicating section, one being expansible and contractible horizontally to fit within or outside of the other section, whereby greater portability and convenience is obtained than is ordinarily possible.

A chain wrench has been patented by Mr. Jules Magnette, of Long Island City, N. Y. It is especially adapted for use in connection with pipes, and is so constructed that the pipe may be turned from right to left, or *vice versa*, without removing the wrench, while it permits of tightening the chain less than the length of the link.

A hoof parer has been patented by Mr. Henry F. Riblett, of Mannington, West Va. It is of the kind made with pivoted arms, one of which has a buttress resting against the horse's hoof and the other a paring knife, the invention providing such a tool with which the paring may be evenly done and the tool be rendered durable.

An inkstand has been patented by Mr. Samuel B. Jerome, of New York City. It has a base with a series of ink wells, and lids so hinged thereto, and connected together by a chain, that the opening of one lid will close all the others, and the writer thus be prevented from dipping his pen in any other than the well in use.

A carriage top has been patented by Mr. Salem E. Kierolf, of Jackson, Tenn. This invention is designed to promote convenience and facility in getting in or out of the carriage, employing, in lieu of the common front bow, a bow restricted in its limits to the canopy or cover, additional braces being connected to the front and middle bows.

An open front heater has been patented by Mr. John Huckans, of Brooklyn, N. Y. This invention relates to portable grates, etc., in which a baffling plate is arranged at the back, below the damper, to cause the heat to be thrown out into the room, the invention providing a convenient adjustment of the plate to suit the state of the fire in the grate.

A ditching machine has been patented by Mr. Isaac N. Knight, of Boise City, Idaho. Combined with a plow beam having plows on its under side is a parallel shaft on which rollers revolve, with means for raising and lowering the beam relatively to the shaft, whereby two or more furrows or ditches for irrigating may be made.

A safety attachment for car heaters and car lamps has been patented by Mr. George F. Seaver, of Dover, N. H. A sliding hood is provided for each heater and each lamp, with various novel details and combinations of parts, whereby, in case of accident to the car, it will not be liable to take fire from the burning fuel in either the heater or lamps.

A door check has been patented by Mr. Benjamin F. Boughn, of Randolph, Neb. It consists of a frame adapted to be attached to the floor, in which is a pivoted spring-actuated lever catch and a sliding abutment, to act as a stop in preventing the door from injuring the wall, and also to hold the door open and prevent it fron slamming to again.

An improvement in gig saddles for harness has been patented by Mr. Marcellus M. Hitt, of Luray, Va. The skirts and tug straps are held by terrets, the straps being folded under at the lower ends and secured permanently to the skirts, in combination with a ring for supporting the thill loop, with a snap hook secured to the loop.

A wire tightener has been patented by Mr. David T. Brown, of Walker, Mo. It is an improved device, comprising a gripper for the wire, a rotating head supporting the gripper, a holder supporting the head or body, and a handle by which to turn the body and the gripper connected with it, for tightening fence and other wires.

A coal chute has been patented by Mr. John H. Du Bois, of Hoboken, N. J. It has a series of tapering hoppers connected together by links, whereby the series of hoppers may be swung out of action one at a time, and with which coal may be loaded from a high coal dock into a vessel below without pulverizing or breaking the coal.

A wagon curtain has been patented by Mr. John H. Hucke, of Brooklyn, N. Y. Ways carrying sliding blocks are secured to the sides of the wagon, arms being attached to the blocks to control the curtain, so that by sliding the blocks toward the front of the wagon the curtain may be lowered and closed, or the curtain may be held half open, or rolled entirely up.

A lead pencil sharpener has been patented by Mr. George H. Coursen, of Baltimore, Md. It has a fixed conical body having a file-like outer face, a swinging arm being pivoted upon the body, provided with a pencil-holding tube, the arm having a rotary motion, the sharpening being accomplished by revolving the arm, and without danger of breaking the point.

A washing machine has been patented by Mr. John R. Welpton, of Red Oak, Iowa. This invention consists of a tubular washing wheel provided with a series of compartments closed by doors and having outer and inner openings for inlet and exit of steam and water, to wash different kinds of clothes at the same time separately and in the same water.

A speed indicator has been patented by Mr. Hezekiah Conant, of Pawtucket, R. I. It consists of a clock gear, a gear for connection with an engine, and a differential gear in mesh with both, having indicator hands moving forward or backward according to the predominance of motion in the clock or engine gear, to conveniently and certainly show the rate of speed of a revolving shaft.

A device for dressing the teeth of saws has been patented by Mr. Wallace C. Yeomans, of Coudersport, Pa. It consists of a frame adapted to slide and carry a file, with means for adjusting the frame in such position in relation to the saw that the file stands at an angle to the teeth, making an implement for side-dressing the teeth accurately on both sides to any desired angle.

A wagon body has been patented by Mr. Felix Burgess, of Darlington, Wis. Combined with the bottom boards are interlocking transverse connecting bars secured to the under side of the bottom, and provided with pivoted buttons, making a body which can be conveniently removed or placed on the wagon by a single person, and which may be knocked down or built up in any small barn or wagon shed.

A thill coupling has been patented by Mr. Oscar P. Barker, of Peoria, Ill. This invention covers a novel construction for the secure attachment and ready detachment of the thills or tongue of a vehicle, so that they may be quickly changed, providing also an anti-rattler, and allowing for the detachment of the horse from the vehicle should he become unmanageable.

The art of ornamenting cards forms the subject of a patent issued to Mr. Charles Schwartz, of Brooklyn, N. Y. The method consists in placing ornamental paper coated with an adhesive in a die having raised letters or ornaments, then placing the sheet to be ornamented on the coated surface of the ornamental paper, and subjecting both to pressure, thus cutting and sticking the latter to the sheet, all in one operation.

A wagon body has been patented by Mr. Richard G. Hart, of Quincy, Mo. This invention is designed to provide for undue wear of the bottom and sides of the body by the bolsters and standards, braces being let into sockets in the bottom of the body and having a stepped or ribbed connection with the sides, angle plates being offset from and applied to the bottom of the body and forming the bottoms of the sockets.

SCIENTIFIC AMERICAN BUILDING EDITION.

SEPTEMBER NUMBER.—(No. 35.)

TABLE OF CONTENTS.

1. Elegant plate, in colors, of a dwelling lately erected on Jersey City Heights, N. J., with floor plans, sheet of details, etc. Cost, fourteen thousand dollars.
2. Elegant plate, in colors, of a comfortable dwelling, costing nineteen hundred and fifty dollars. Floor plans and details.
3. Perspective view and floor plans of a beautiful residence at Rochelle Park, near New York. Our engraving was made from a photograph taken specially for the SCIENTIFIC AMERICAN BUILDING EDITION.
4. Perspective and floor plans of the residence of I. C. Goodridge, Esq., at Rochester, N. Y.
5. A Queen Anne cottage lately erected in Rochelle Park, near New York. Perspective and floor plans. Cost, five thousand six hundred dollars, complete.
6. A beautiful seaside cottage, at Bath Beach, Long Island. Floor plans and perspective. Cost, about two thousand five hundred dollars.
7. A modern cottage for eighteen hundred dollars, lately built, at Asbury Park, N. J. Perspective and floor plans.
8. A beautiful house in the colonial style, lately erected, in Rochelle Park, New Rochelle, N. Y. Perspective view and floor plans. Cost, ten thousand dollars, complete.
9. Engraving showing perspective, with accompanying plans, of a six room cottage, lately erected on Hancock Avenue, Bridgeport, Conn., at a cost of sixteen hundred dollars.
10. A one thousand dollar cottage, built at Bridgeport, Conn. Perspective and plans.
11. A cottage for two thousand eight hundred dollars, built at Bridgeport, Conn. Plans and perspective.
12. A basement cottage, lately built, at Bath Beach, Long Island, at a cost of two thousand three hundred dollars, complete. Floor plans and perspective.
13. Page of engraving showing various residences and hotels.
14. Photographic illustration showing a cottage for two thousand five hundred dollars, built at Bridgeport, Conn. Perspective and floor plans.
15. A residence at Nangis. Plans and perspective.
16. A beautiful double house for four thousand five hundred dollars, lately erected in Bridgeport, Conn. Perspective view and floor plans.
17. Miscellaneous contents: Ancient use of bronze.—An experiment in optics.—Planting ornamental trees.—Disinfection of sewers.—The rose jar.—Effect of time on slaked lime.—How to build a barn, with plans. — Interior finish. — Seamless eaves troughs with mitered corners (illustrated).—The oscillation of high chimneys.—Imitative and conventional ornament.—A model Boston kitchen.—Weeds. — Artistic furniture (illustrated). — Improved ventilating fans (illustrated).—Bent glass for circular fronts and towers.—Stains for coloring and tinting mortar.—Roof painting.—The Florida steam and hot water heaters (illustrated).—A venerable larch.

The Scientific American Architects and Builders Edition is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming, practically, a large and splendid MAGAZINE OF ARCHITECTURE, richly adorned with elegant plates in colors and with fine engravings, illustrating the most interesting examples of Modern Architectural Construction and allied subjects.

The Fullness, Richness, Cheapness, and Convenience of this work have won for it the LARGEST CIRCULATION of any Architectural publication in the world. Sold by all newsdealers.

MUNN & CO., PUBLISHERS,
361 Broadway, New York.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Mechanical drawing, calculations, etc., taught by correspondence. I. Donald Boyer, Dayton, Ohio.

Wanted—A mechanic in every shop in the world to act as agent. No interference with regular work. No capital. Free samples and good commissions. Send for samples and particulars to F. N. Carter, 176 St. Clair St., Cleveland, O.

A System of Easy Lettering. By J. H. Cromwell. 26 plates. Price, 50 cents. E. & F. N. Spon, 12 Cortlandt St., New York.

Steam Launches.——New catalogue (free) by Chas. P. Willard & Co., 236 Randolph St., Chicago.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

Pratt & Letchworth, Buffalo, N. Y.,
solicit correspondence relative to manufacturing specialties requiring malleable gray iron, brass, or steel castings.

For the latest improved diamond prospecting drills, address the M. C. Bullock Mfg. Co., Chicago, Ill.

Supplement Catalogue.—Persons in pursuit of information of any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Nickel Plating.—Manufacturers of pure nickel anodes, pure nickel salts, polishing compositions, etc. $100 "*Little Wonder.*" A perfect Electro Plating Machine. Agents of the new Dip Lacquer Kristaline. Complete outfit for plating, etc. Hanson, Van Winkle & Co., Newark, N. J., and 92 and 94 Liberty St., New York.

Perforated metals of all kinds for all purposes. The Robert Aitchison Perforated Metal Co., Chicago, Ill.

The *Railroad Gazette*, handsomely illustrated, published weekly, at 73 Broadway, New York. Specimen copies free. Send for catalogue of railroad books.

The Knowles Steam Pump Works, 113 Federal St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

Link Belting and Wheels. Link Belt M. Co., Chicago.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

The Holly Manufacturing Co., of Lockport, N. Y., will send their pamphlet, describing water works machinery, and containing reports of tests, on application.

Lockwood's Dictionary of Terms used in the practice of Mechanical Engineering, embracing those current in the drawing office, pattern shop, foundry, fitting, turning, smith's and boiler shop, etc., comprising over 6,000 definitions. Edited by a foreman patternmaker. 1888. Price, $3.00. For sale by Munn & Co., 361 Broadway, New York.

Duplex Steam Pumps. Volker & Felthousen Co., Buffalo, N. Y.

Catalogue of Books on Civil, Mechanical, and Electrical Engineering, Arts, Trades, and Manufactures, 118 pages, free. E. & F. N. Spon, 12 Cortlandt St., New York.

Pedestal tenoner. All kinds woodworking machinery. C. B. Rogers & Co., Norwich, Conn.

Billings' Patent Breech-loading Single Barrel Shotgun. Billings & Spencer Co., Hartford, Conn.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Hoisting Engines, Friction Clutch Pulleys, Cut-off Couplings. The D. Frisbie Co., 112 Liberty St., N. Y.

Veneer machines, with latest improvements. Farrel Fdry. Mach. Co., Ansonia, Conn. Send for circular.

"How to Keep Boilers Clean." Send your address for free 88 page book. Jas. C. Hotchkiss, 120 Liberty St., N. Y.

Lathes for cutting irregular forms. Handle and spoke lathes. I. E. Merritt Co., Lockport, N. Y.

Wardwell's patent saw benches. All sizes in stock. Rollstone Machine Co., Fitchburg, Mass.

"New Drill Chuck," holding straight taper or square shanks. Address Standard Tool Co., Cleveland, O., mfrs. of twist drills, reamers, and special tools.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Patents Bought & Sold. H. W. Booth & Co., Detroit, Mich.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1) E. J. T. asks: If there is a stove polish manufactured in the form of a paste, which will not black a person's hands? A. Not that we know of. An excellent polish consists of 2 parts of copper sulphate, 1 of bone black, 1 of black lead, with sufficient water to form a creamy paste.

© 1888 SCIENTIFIC AMERICAN, INC.

(2) M. H. S. asks for a novelty for his show window. A. Arrange a light tin velvet-covered coffin so as to be held in mid-air by a magnet and held down by two fine silk threads. Use a black background, and the threads will be unseen, and you will have a representation of "Mahomet's coffin."

(3) Millwright writes: Please explain whether there is or is not a place in the center of a revolving shaft which does not turn? A. All places and particles in a revolving shaft turn with it. There is no place that does not turn.

(4) J. J. S. writes: 1. I have completed a handsome design of the simple electric motor as described March 17, SCIENTIFIC AMERICAN. Have followed directions very carefully and minutely, also watched and benefited by the correspondence on same in your columns. Made my field magnet of solid wrought iron ½ inch thick, 2½ inches wide, with 1¼ inch square, iron clamped and bolted between the ends, and all connecting surfaces filed true. Armature ring core is No. 18 soft iron made as described, and I got on 11 coils of 8 convolutions, each 4 layers deep, and could only get 7 convolutions in the 12th coil. The contact of each coil with the brass commutator screw is perfect. I commenced to wind field magnet coils at inside end each coil, and connected as per corrected description in SCIENTIFIC AMERICAN. My armature runs true without any vibration at all, and brushes of copper on hard rubber disk are all connected up as described. The coils on armature are encircled by two bands each consisting of five strands silver-plated steel wire No. 28. I run the motor 2,500 revolutions per minute by attaching it to our mill, and it did not generate any electric current. I attached two wires from a two-jar Diamond carbon battery to its binding posts, and it would not turn the motor, but when I revolved the armature myself I could see brilliant electric sparks flowing between the copper brushes and the brass screw heads. Each jar contained 7 carbon rods ⅛×7 inches and 1 zinc rod. Can you tell me where to remedy the defect, if any, in my motor? Will not 4 jars Diamond carbon battery run one sewing machine by the motor? A. By making your armature coils of unequal size you have introduced one element of weakness. The coils should be all of the same size. With due care 12 coils of full size can be wound on the armature core. You should replace your steel binding wire with hard drawn brass. One binding at the center is sufficient. Two cells of Diamond carbon battery are insufficient to move the motor. It requires 6 or 8 large cells of plunging bichromate battery. 2. Will I be infringing on any one if I should construct the 8 light dynamo for my own use? A. We believe there is nothing in the dynamo that is covered by existing patents.

(5) D. M. B.—Almost any transmitter and receiver when carefully adjusted and used on a clear, well insulated line, with the maximum of battery, and with a resonator attached to the receiver, may be heard over a distance of 25 or 30 feet in a very quiet place. Edison's loud-speaking telephone may be heard farther than that. Probably the reason why loud-speaking telephones are not more largely in use is that they require more care and attention than the ordinary ones.

(6) H. M. asks: 1. How must I change the simple electric motor to receive twice the power? A. Make it one-half larger in all of its dimensions, linear. 2. How many watts are equal to one man's power? A. ⅛ horse power is generally allowed for a man power, equal to 93¼ watts. 3. What battery will last longest, and which will give most power—Bunsen, Smee, or Grenet, all being of same size? A. Of the three named, the Bunsen will give the most power for the longest time on the average. At first the Grenet or Smee will give more current, but it will soon run down. 4. How large a spark can I obtain from an induction coil which is 7 inches long, being wound with 2 layers of No. 16 cotton covered wire and about 6 ounces of No. 38 silk covered wire, the core being made of No. 18 iron wire 1 inch in diameter, using 4 cells of half gallon Smee batteries? A. Probably not more than ¼ inch. To get the best effect from your coil you should use at least twice as much fine wire. 5. How can I make an electric cartridge of small size, which can be set off with an induction coil? A. In a wooden or paper cartridge shell insert two wires from opposite sides to within one sixteenth inch of each other, then fill in with powder. Connect the wires with the terminals of your induction coil. 6. How can I make a good resistance box, such as used to govern electric currents? A. Make it of coils of insulated German silver wire of different sizes and lengths.

(7) K. B. asks: 1. Could a secondary battery charged by four gravity cells be adapted to the simple electric motor? A. It is possible, but not practicable. It would require a long time to charge the requisite number of secondary cells. 2. If so, could I make one like Gaston Plante's, using the alloy which comes with tea instead of the lead most used? A. The lead is too thin. It would last only a very short time. 3. Could you turn the motor into a dynamo, giving the same current that would be required to run the motor? A. When run as a dynamo, it would not produce the current required to run it as a motor. 4. Could you use No. 12 or 14 iron wire for the armature ring? A. Yes.

(8) F. A. W. H. writes: In talking about hydraulic presses, I said that in launching the Great Eastern the weight was so tremendous, the vessel being sent off sideways, and the ground sinking, that the water used in the presses was driven through six inches of iron, not pouring through, but standing out in beads. My listener refused to believe such a thing possible—that water could be driven through iron; and so we agreed to refer it to you. A. Driving water through iron in this way is not an unusual phenomenon with hydraulic cylinders. They will leak ammonia when they will not show water.

(9) W. H. R.—The walls of ice houses should be started from the bottom with hay packing at least 6 inches thick, with tight board lining inside and double row of hay packing above ground. Pack the ice with 6 inches of hay next to the walls all around. Hay is better than straw to confine the air in the packing. Place 2 to 3 feet of hay on top of the ice. Take out the ice from the top, always covering as soon as possible.

(10) A. P. S. asks for some paste or grease that can be applied to advantage to gun barrels used in sea ducking to prevent rust. When the sea is rough, water often comes over the side of the boat and drenches the gun. Oils and vaseline are not effective, being washed off by the first few waves. A. Try melted paraffine or beeswax. Warm the gun and smear a thin coat of wax on the metallic parts of the gun with a rag. Or clean the gun free from grease, and varnish with shellac or spar varnish. Clean when required with alcohol or turpentine.

(11) F. W. S. asks (1) a receipt for making a black that will stand, on the stack and smoke arch of a locomotive. A. Paint the stack with thin coal tar mixed with finely ground plumbago. Make of the consistency of ordinary paint. 2. A receipt for polishing brass. A. Tripoli and engine oil on a cloth is all that is necessary for polishing the brass work of a locomotive; wipe often with an oily cloth. Too much polishing wears off corners and edges, and soon makes the brass work look old from wear.

(12) R. A. W. asks (1) if there is any cement or glue that will fasten rubber to iron. A. Pitch and gutta percha equal parts melted together will cement rubber to iron. 2. What quick process is there to grind small white brook pebbles down to any shape? A. Use corundum wheels, such as are used by dentists for grinding porcelain teeth. They must be used wet.

(13) C. V. asks: 1. How many 2 quart Bunsen batteries does it take to operate a 2 candle lamp? A. It depends upon the resistance of the lamp. Probably two cells would answer. 2. Will such a lamp give as much power of light as a common Christmas tree candle? A. Yes. 3. Also how many batteries 2 quart Bunsen does it take to light a six candle lamp? A. Four.

(14) H. P. M. asks: 1. How near could the poles of a circular magnet be, and still give the full force of the magnetism? A. It depends upon the size of the magnet. Probably the most favorable distance can be determined only by experiment. 2. What kind of steel is best for a permanent magnet of true circular form? A. Chrome steel. 3. Would there be any attraction at any other part of the circle besides at the poles? If so, would it be the same at all points around the circle? A. It would diminish to zero gradually as the distance from the poles increased. 3. Where could I get a magnet of this kind made and charged? A. By any of the manufacturers of electrical instruments. See our advertising columns.

(15) F. W. G.—The size and insulation of wire for dynamos and motors depend entirely on the kind of motor or dynamo and the kind of current passing through its conductors. A high tension current requires better insulation than a low tension current. Nothing poorer than the best double covered wire should be used.

(16) C. V. A.—The dynamo described in SUPPLEMENT, No. 161, will run three 5 candle power Edison lamps. It is not an easy matter to make a good storage battery; you can however make an experimental one by roughening lead plates, coating them with a paint made of red lead and dilute sulphuric acid—water 10 parts, acid 1 part—separating the plates by rubber bands arranged vertically, and connecting alternate plates with one pole of the dynamo and intermediate plates with the other pole.

(17) R. B. H.—1. Cast iron will not answer well for the core of the armature ring of the simple electric motor, as it is not readily magnetized and demagnetized. 2. The wire sent is No. 20; it is too small for the armature winding.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

August 28, 1888,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Acid distributer, sulphuric, S. Frazier 388,406
Anatomical apparatus, E. Smith 388,593
Badge holder, G. B. Franks 388,405
Bag. See Paper bag.
Baling press, C. Peterson 388,579
Banjo, J. F. Luscomb 388,781
Bar. See Finger bar. Grate bar. Pinch bar. Truck bar.
Barrow, W. M. Potts 388,715
Basket, E. N. Little 388,425
Batteries, electrode for secondary, S. L. Trippe 388,601
Batteries, electrode for storage, J. T. Van Gestel 388,746
Battery. See Galvanic battery.
Battery zincs, making, Carr & Borden 388,628
Beehive, T. M. Cobb 388,761
Beer cooling device, J. F. Theurer 388,742
Bell ringer, steam, G. B. Snow 388,736
Belt, electric, H. P. Pratt 388,581
Belt shifter and tightener, S. Shive 388,729
Belts, apparatus for stretching, M. Gandy 388,551
Binder, temporary, W. D. Ready 388,717
Blind finishing machine, L. Rivers 388,447
Blower, folding fire, J. M. McMeen 388,571
Blower, rotary pressure, G. Crowell 388,639
Boat, H. E. McGuire 388,783
Boot, lumberman's, J. H. Stickney 388,597
Boot or shoe nailing machine, J. E. Cutlan 388,640
Boots or shoes, attaching heels and top lifts to, C. W. Glidden 388,553
Bottle stopper, W. A. Bond 388,525
Box. See Fire alarm signal box.
Bracket. See Window shade bracket.
Brake. See Car brake.
Bucket, well, J. L. Van Hook 388,747
Bullet, F. P. Langfitt 388,496
Burglar alarms, circuit changing device for, F. H. Nutter 388,438
Burner. See Liquid fuel burner. Hydrocarbon burner.
Button, E. S. Dodge 388,402
Button fastener, C. M. Platt 388,443
Calendar or memorandum roll, H. S. Hack 388,411
Calipers, micrometer, E. J. Hadley 388,669
Can. See Creaming can.
Cannon, making, J. P. Lavigne 388,696
Car brake, J. W. Sims 388,731
Car coupling, H. H. Burden 388,336
Car coupling, A. W. Burnham 388,756
Car coupling, G. W. Cisco 388,633
Car coupling, H. B. Johnson 388,777
Car coupling, L. Showalter 388,792
Car, dumping, J. W. Nesmith 388,708
Car, electric tram, J. T. Van Gestel 388,514
Car heaters and car lamps, safety attachment for, G. F. Seaver 388,590
Car loader, W. H. Jennings 388,494
Car, railway, C. M. Smith (r) 10,955
Car seat, H. S. Hale 388,412
Car signal, railway, Larned & Sill 388,420
Car, stock, C. Hager 388,671
Cars, coupling device for street, F. A. Pierce 388,506
Cars, propelling and heating street, W. E. Prall 388,444
Cars, ventilating, H. Penoyer 388,504
Carding engine, J. M. Hetherington 388,679
Cards, ornamenting, C. Schwartz 388,589
Carpet fabric, J. Humphries 388,682
Carpet sweeper, W. J. Drew 388,768
Carriage top, S. E. Kierolf 388,689
Cart, road, L. Miller 388,704
Case. See Cigarette case. Filing case.
Caster, C. Stengel 388,460
Centrifugal force, apparatus to illustrate, J. Coffin 388,476
Chain wrench, J. Magnette 388,568
Chamois holder, A. T. Veeder 388,800
Chuck, jeweler's lathe, H. N. Moseley 388,573
Churn, W. H. Curtice 388,537
Churn, R. & T. Stockdale 388,740
Chute, coal, J. H. Du Bois 388,542
Cigar bunching machine, M. A. Winget 388,802
Cigarette case, J. Berthel 388,617
Cleaner. See railway track cleaner. Stove pipe or flue cleaner.
Clocks, electric motor for self-winding, F. W. Brainerd 388,632
Clothes drier, G. Conover 388,635
Clothes drier, G. Cox 388,478
Clutch, friction, S. H. Pitkin 388,580
Coffin fastener, M. Bremer 388,624
Commode, earth closet, or similar appliance, C. L. Doll 388,541
Condiments and the like, pot for, R. H. Finlay 388,657
Conduit, fluid, S. L. Bailey 388,616
Cooking vessel, C. J. Parker 388,500
Cooling rooms, etc., ammonia system for, J. Ring 388,722
Corset, M. P. Bray 388,623
Cotton scraper and sweep, W. R. Craig 388,398
Coupling. See Car coupling. Thill coupling.
Crank pins, device for turning, T. Urquhart 388,745
Creaming can, C. W. Parks 388,501
Creosote, etc, obtaining, F. S. Clark 388,529
Cuckoo, G. R. Olney 388,439
Cup. See Oil cup.
Cutter. See Paper cutter. Rotary cutter.
Cutter heads, tread guard for, J. L. Packard 388,578
Damper regulator, F. Leclere 388,699
Dental electric apparatus, C. A. Eisenhart 388,482
Dental matrix, H. P. Booth 388,619, 388,620
Desk, school, M. W. Kidder 388,417
Ditching machine, I. N. Knight 388,566
Door check, B. F. Boughn 388,621
Door plate and letter box door, combined, R. Stafsvick 388,596
Dovetailing machine, N. S. Clement 388,760
Drier. See Clothes drier.
Drill grinding attachment, twist, F. Mossberg 388,784
Drilling device, A. K. Cross 388,637
Drilling device, P. M. Sharples 388,456
Drum, E. Zoeller 388,806
Drum, military, B. Fleck 388,771
Drums, snare tightener for, J. H. Buckbee, Jr 388,527
Eaves gutter hanger, M. Koch 388,495
Eccentrolinead, A. J. Tyler 388,799
Educational apparatus, I. F. Hall 388,486
Electric arc light support, Schardt & Jones 388,723
Electric conduit, underground, E. H. Phipps 388,442
Electric light carbons, furnace for baking, J. Burns 388,757
Electric machines, commutator for dynamo, J. T. Van Gestel 388,513
Electric meter, H. G. Morris 388,707
Electric meter, K. Raab 388,583
Electric motor, J. Batley 388,753
Electric motor, J. T. Van Gestel 388,512
Electric wires, suspending overhead, A. E. Harris 388,487
Electrical conductor, W. A. Conner 388,477
Electrotype dies, making, J. W. Tufts (r) 10,956
Elevator. See Hydraulic elevator.
Elevator, Bullock & Hanson 388,627
Elevator, G. A. Weld 388,469
Elevator gate, automatic, A. Miller 388,431
Engine. See Carding engine. Rotary engine. Steam engine. Traction engine.
Engine shafts directly to the driven machines, device for gearing, E. H. Hewins 388,415
Engines, variable expansive and reversing motion for oscillating cylinder, J. W. Hartley 388,558
Eraser, blackboard, H. C. Goodrich 388,555
Eyeglasses, nose guard for, G. H. Emerson 388,545
Fabric. See Carpet fabric.
Fabric turfing implement, D. Lewis 388,422
Fan or brush, fly, H. Rembert 388,719
Faucet, right and left hand stop and waste, W. Briggs 388,526
Feathers, machine for reducing, C. Wolff 388,517
Feed trough, W. Andrus 388,520
Feed trough, Hughes & Wade 388,493
Fence, N. Shaffstall 388,725
Fence machine, W. Peeper 388,503
Fence making machine, L. T. Curtis 388,400
Fence making machine, A. K. Degood 388,643
Fence making machine, J. Zengel 388,610
Fence, picket and barbed, J. Locher 388,780
Fence, portable, E. Demuth 388,644
Fence, wire, B. Scarles 388,450, 388,451
Fertilizer distributer, W. W. Turnipseed 388,511
File and binder, letter, B. Lawrence 388,421
Filing case, B. H. Morgan 388,498
Filter, oil, G. W. Gallaway 388,550
Finger bar, L. D. Minnick 388,705
Finger shield, A. Ahlquist 388,519
Fire alarm signal box, electric, S. A. Chase 388,631
Fire alarms, thermal circuit closer for, Petit & Bresson 388,505
Fire arms, rust preventer for, C. I. Wooster 388,804
Fire escape, L. Hill 388,491
Fire extinguisher, I. N. Goodnight 388,773
Fire extinguisher for railway cars, F. E. Squire 388,738
Fishing rod holder, A. F. & W. Meisselbach 388,433
Forming tool, W. W. Emerson 388,652
Frame. See Tobacco frame.
Frog or car replacer, portable, W. O. Cooke 388,397
Fruit jar, G. H. Harvey 388,488
Furnace fuel feeder, A. Warne 388,468
Fuse lighter, W. H. Randall 388,716
Galvanic battery, A. V. Meserole 388,430
Gas condenser and tar separator, F. Bredel 388,474
Gaseous fuel, apparatus for the manufacture of, A. Thompson 388,465
Gate. See Elevator gate. Water gate.
Gate, D. England 388,653
Gate, J. W. Paulen 388,502
Gate, J. B. Rowe 388,789
Gill boxes, etc., device for lowering the fallers in, J. Stake 388,739
Glass mould, W. Haley 388,556
Grain binders, bundle carrier for, H. J. Case 388,630
Grain binders, packing mechanism for, J. S Davis 388,642
Grain hoppers, means for operating the slides of, J. Dable 388,641
Grate, F. S. Bissell 388,473
Grate bar, Kitson & Reagan 388,691
Grate bar, J. Mahony 388,426
Grate for furnaces, stoves, etc., fire, G. C. Dunklee 388,647
Grinding machine, F. C. Hall 388,672
Grinding mill, roller, W. D. Gray 388,661
Grooving machines, cutter head for, J. T. Grzybowski 388,410
Guns, breech mechanism for, T. Nordenfelt 388,576
Hair crimper, N. Allen 388,387
Handle. See Trunk handle.
Hanger. See Eaves gutter hanger. Vehicle spring hanger.
Hardening and tempering by electricity, apparatus for, P. Diehl 388,645
Harness, M. M. Hitt 388,560
Harness hooks, wear plate for, W. B. Hayden 388,676
Harrow, C. La Dow 388,567
Harrow disks, machine for grinding, E. A. Sloat 388,732
Harrow tooth, cultivating, C. C. Crumb 388,536
Harrows, machine for making disks for, W. J. Hogan 388,561
Harvester, J. S. Davis 388,765
Harvester, corn, P. R. Hunt 388,684
Harvester, grain binding, A. O. Slentz 388,793
Harvester guard renovator, G. W. East 388,543
Hasp lock, L. A. Brown 388,394
Hat brims, machine for shaping, L. H. Hoyt 388,492
Hats, adjustable block for stretching, J. E. McLoughlin 388,497
Hay or grain cock weather shield, J. A. & L. R. Symmes 388,795
Hay press, W. A. Laidlaw (r) 10,954
Hay rake, horse, B. Desautels 388,401
Heater. See Open front heater. Water heater.
Heating apparatus, E. E. Gold 388,772
Heating, cooking, and vaporizing apparatus, portable combination gas, H. P. Miller 388,432
Heel beading machine, J. H. Ryder 388,790
Heeling machine, A. E. Ellis 388,544
Heeling machines, manufacture of nail dies for, E. Merritt 388,535
Hemp, jute, ramie, etc., machine for disintegrating, J. J. Green 388,663
Hemp, ramie, etc., machine for disintegrating, J. J. Green 388,662
Hemp, ramie, etc., machine for treating, J. J. Green 388,664, 388,665
Hinge, J. M. Grau 388,409
Holdback, vehicle, J. P. Van Dusen 388,466
Holder. See Badge holder. Chamois holder. Fishing rod holder.
Hoof parer, H. F. Riblett 388,585
Hopple, B. Spieth 388,737
Horse power, A. Sampson 388,586
Horseshoeing rack, S. M. Martin 388,569
Horse tail tie, C. D. Haldeman 388,670
Hose connection, M. W. Webb 388,748
Hose nozzle supporter, O. P. Prescott 388,788
House, portable, A. Lindblad 388,424
Hydrant, A. J. Tyler 388,798
Hydraulic elevator, E. Hunt 388,683
Hydrocarbon burner, J. Reid 388,718
Ice or refrigerating machine, J. E. Siebel 388,592
Incrustation preventive, D. H. Cameron 388,759
Indicating and calculating machine, P. Yoe 388,518
Indicator. See Railway station indicator. Speed indicator. Street or station indicator.
Ingot manipulator, O. P. Mason 388,570
Inkstand, S. B. Jerome 388,564
Insect powder blower, E. W. Mersereau 388,702
Ironing machine, G. J. Fritz 388,660
Jar. See Fruit jar.
Key. See Loop key.
Knitting machine, N. W. Pierce 388,786
Knitting machine, circular, H. C. Rightmire 388,721
Knitting machines, stop motion for, R. B. Goodyear 388,774
Knitting stockings, S. Henshall 388,678
Ladder, extension fire, T. W. Russell 388,448
Ladder, step, O. M. Sweet 388,599
Lamp, arc, J. Lea 388,697
Lampblack, apparatus for the manufacture of, S. Cabot, Jr 388,475
Lamp, central draught, F. Rhind 388,445
Lamp, electric arc, Spencer & Jaquith 388,594
Lamp, incandescent gas, H. Shaw 388,727
Lantern, tubular, W. C. Whitney 388,470
Last, Bickford & Stetson 388,618
Last, H. M. Goodhue 388,554
Lasts, anvil heel shouldering machine in the manufacture of, W. Thompson 388,744
Lasting machine, T. O'Bolger 388,577
Lathing, metallic, B. Scarles 388,449
Leather splitting machine, D. Knox 388,419
Leather stretching machine, W. E. Adams 388,611
Life preserver or buoy, F. Gregson 388,667
Liquid fuel burner, C. J. Edmonds 388,649, 388,650
Lock. See Hasp lock. Nut lock.
Loom, H. Talks 388,463
Loom shuttle, self-threading, J. B. Daudelin, 388,539, 388,540
Loom take-up mechanism, F. A. Arbenz 388,615

© 1888 SCIENTIFIC AMERICAN, INC.

Loop key, C. E. Scribner 388,453
Match boxes, machine for sanding, Preston & Whalen 388,582
Measuring apparatus, electric resistance, C. E. Scribner 388,454
Measuring vessel, G. Hayes 388,677
Mechanical motor, P. Hockett 388,416
Mechanical movement, C. C. Barton 388,390
Metal sawing machine, portable, C. W. Trowbridge 388,602
Metal wheel, E. Sharbonneau 388,455
Metals, machine for drawing, W. A. McCool 388,782
Meter. See Electric meter. Piston meter.
Mill. See Grinding mill. Roller mill.
Mixing apparatus, B. Schumm 388,724
Mould. See Glass mould.
Mole and gopher trap, C. Van Wormer 383,515
Mop wringer, Noble & Warren 388,710
Motor. See Electric motor. Mechanical motor. Sewing machine motor. Water motor.
Mowing machine, Stoddard & Brown 388,741
Nail plate feeder, Harden & Grant 388,673
Nut lock, O. R. Cooke 388,761
Nut lock, W. Sleicher, Jr 388,508
Oar, spring jointed boat, C. G. Van Fleet 383,467
Oil, apparatus for burning hydrocarbon, G. R. Seymour 388,507
Oil cup, B. J. Downs 388,767
Open front heater, J. Huckans 388,562
Ore concentrator, Frank & Wicks 388,659
Ore separator, J. Talley 388,464
Organ, reed, J. Hessler 383,490
Organ, reed, G. R. Newman 388,439
Organs, manual coupler for, J. Hessler 388,489
Packing boxes, metal strap for, S. C. Cary 383,629
Paper bag, D. Appel 388,614
Paper bags, making, D. Appel 388,612, 388,613
Paper cutter, L. Ehrlich 388,651
Paper, sheathing, T. Manahan 383,700
Paper tubes, machine for making, C. S. Tainter 388,462
Pavements, construction of, I. L. Landis 388,694
Pencil sharpener, lead, G. H. Coursen 388,533
Photographic burnishing machine, A. H. Humphrey 388,681
Photographs, pictures, etc., frame for, H. Pattberg 388,712
Pianoforte, J. P. Richardson 388,720
Picker stems, constructing, G. N. Todd 383,797
Pinch bar, A. Stockdale 388,461
Pipe. See Stove pipe.
Pipe wrench, D. B. Whitehill 388,607
Pipes in trenches, apparatus for placing hydraulic and other, D. A. Streeter 388,598
Piston meter, F. Perret 383,714
Planing machines, gauge and feed attachment for buzz, S. S. Raymond *et al.* 388,581
Planter, J. A. Cumming 388,399
Planter, check row, J. Clark 388,530
Planter, check row corn, I. F. Wilcox 388,749
Planter, combined corn and cotton, J. D. Schofield 388,452
Plants containing indican, treating, P. P. F. Michea 383,703
Plow attachment, C. W. McCormick 383,428
Plow, reversible, C. H. Farley 388,655
Poison bottles, precautionary device for, F. H. Nutter 388,785
Pot. See Tea and coffee pot.
Power. See Horse power.
Press. See Baling press. Hay press. Stamping press.
Printing machines, inking apparatus for, Hoe & Weckerlin 388,680
Projectile, Hawley & Hurst 388,413
Propelling apparatus for boats, Buck & Burckard. 388,395
Rack. See Horseshoeing rack. Wood rack.
Railway, cable, G. W. Douglas (r) 10,953
Railway station indicator, electric, G. H. Kirwan. 388,690
Railway track cleaner, street, C. E. Doty 388,403
Railways, cable grip for traction, O. H. Jadwin 388,686
Railways, signaling apparatus for cable street, H. W. Smith 388,459
Rake. See Hay rake.
Regulator. See Damper regulator.
Ring. See Yoke ring.
Rivet, S. W. Shorey 388,458
Rock drilling machine, J. A. Pashley 388,711
Rod. See Saw rod.
Roller mill, A. J. Shontz 388,730
Rolling machine, metal, D. E. Kempster 383,565
Rolling mills, protecting device for, J. Paton 383,440
Rolling train, W. Bansen 388,389
Rotary cutter, C. H. Benjamin 388,523
Rotary cutter, H. P. Fairfield 388,548
Rotary cutter, Fairfield & Benjamin 388,547
Rotary cutter, J. F. Freeman 388,549
Rotary cutter, C. W. Glidden 388,552
Rotary engine, J. E. Beauchemin 388,522
Rule, carpenter's, M. H. Walsh 388,605
Saddle, harness, A. H. Larkin 388,695
Sash fastener, W. P. Coldren 388,762
Saw rod, J. M. Koeberle 388,779
Saws, device for dressing the teeth of, W. C. Yeomans 388,805
Scoop, corn, J. A. Johnson 388,687
Seat. See Car seat. Vehicle seat.
Separator. See Ore separator.
Sewing machine, button, R. Thompson 388,796
Sewing machine for stitching uppers to soles, wax thread, G. Amborn, Jr 388,752
Sewing machine motor, E. F. Briggs 388,598
Shafting, machine for straightening, W. J. Muncaster 388,574
Shafts, anti-friction step for, P. M. Sharples 388,457
Sheet metal beading machine, W. J. Bayrer 388,471
Sheet metal puncturing machine, Waelde & Cery 388,604
Shells, multiple primer for, N. W. Pratt 388,787
Shelves, book support for, M. W. Harrington 383,674
Shoe rest, Huntington & Tracy 388,685
Sifter, L. M. Nixdorff 388,575
Signal. See Car signal.
Skate, J. A. La Chaine 388,693
Sled roads, device for making, H. B. Frey 388,407
Sleigh, J. W. & H. Cox 388,534
Sole edge burnisher, C. Amazeen 388,751
Sower, broadcast seed, T. Grubb 388,485
Speed indicator, H. Conant 388,532
Spinning machines, device for pasting cop bottoms on, Cooper & Cordingley 388,636
Spinning spindles, step for, J. Booth 388,392
Spoke socket, M. L. Smith 388,735
Spring. See Vehicle spring.
Springs, machine for making wire, O. S. Foster 388,658
Square and protractor, combined, J. D. Smith 388,734
Stamp, hand, H. H. Norrington 388,437
Stamping press, F. M. Leavitt 388,698
Stanchion, H. C. Miner 388,572
Steam engine, J. Bonicard 388,755
Stone composition, artificial, C. A. Shank 388,726
Stopper. See Bottle stopper.
Storage battery plate, C. D. P. Gibson 388,668
Store service apparatus, H. Hebert 388,559
Stove, charcoal burning cooking, C. Morse 388,435
Stove pipe or flue cleaner, R. G. Smith 388,794
Straightening machine, W. A. McCool 388,701
Street or station indicator, C. F. Niklaus 388,709
Sugar evaporator, E. B. Everingham 388,546
Supporter. See Hose nozzle supporter.
Switch. See Tramway switch.
Switch for tracks for carrying iron, E. A. Kern 388,698
Syringe, vaginal, D. J. Terrell 388,510
Tea and coffee pot, portable, E. E. C. Thompson 388,600
Telegraphy, P. B. Delany 388,481
Telegraphy, railway, G. T. Woods 388,803
Telephone exchanges, switch board for, C. E. Scribner 388,791
Thill coupling, O. P. Barker 388,521
Thrashers, grain separator for, J. T. Fenton 388,483
Thrashing machines, band cutter and feeder for, J. H. Spurgin 388,595
Tie. See Horse tail tie.
Tire bolter and cutter, W. A. Johnson 388,778
Tobacco frame, J. F. Drury 388,646
Trace fastener, C. H. McDonald 388,429
Traction engine, E. M. Knollin 388,692
Traction wheel, G. E. Lewis 388,423
Tramway switch, C. E. Andersson 388,388
Trap. See Mole and gopher trap.
Traveler or trolley, L. Daft 388,538
Trough. See Feed trough.
Truck bar, J. H. Fisher 388,770
Truck, safety car, H. D. Thompson 383,743
Truck, stove, B. O. Wilson 388,516
Trunk attachment, C. W. Clifton 388,534
Trunk handle, G. Crouch 388,638
Truss, J. Wilke 388,608
Twisting frames, etc., stop motion for, Smith, Jr., & Ambler 388,509
Type, printer's, J. G. Pavyer 388,713
Valve, A. D'Lanoy 383,766
Valve controller, thermotic, G. W. Blake 388,754
Valve for incubators, thermostatic, M. S. Greenleaf 388,666
Valve, steam engine, J. Heath 388,414
Valve, steam exhaust pipe, J. Erwood 388,654
Vehicle, M. F. Goodrich 388,408
Vehicle, road, M. M. Conger 388,763
Vehicle running gear, A. Bock 388,524
Vehicle seat, J. M. Perkins 388,441
Vehicle spring, W. M. Eccles 388,769
Vehicle spring, A. Schubert 388,587
Vehicle spring hanger, A. Schubert 388,588
Vehicle top curtain, J. H. Shaubach 388,591
Vehicle, two-wheeled, J. W. Vornick 388,603
Vehicles, shifting seat for, E. H. Bates 388,391
Velocipede, J. M. Marlin 388,427
Velocipede, D. H. Rice 388,446
Velocipede saddle, A. L. Garford 388,484
Velocipede step, G. H. Day 388,480
Vessel for transporting breakable goods, L. Sloan 388,733
Wagon bed, A. H. Hall 388,557
Wagon body, F. Burgess 388,528
Wagon body, R. G. Hart 388,675
Wagon, coal, J. R. Wilson 388,801
Wagon curtain, J. H. Hucke 388,563
Wall paper, F. Beck 388,472
Washing machine, W. F. Moore 388,706
Washing machine, J. Shepherd 388,728
Washing machine, J. R. Welpton 388,606
Watch, stem winding, S. A. Durgin 388,648
Watches, cannon pinion for, L. C. Briggs 388,625
Watches, setting mechanism for, A. Fischer 388,404
Water gate, C. J. Cheney 388,632
Water heater sectional, W. Kirkwood 388,418
Water motor, J. Wilhelm 388,750
Water wheel, current, L. Colt 388,531
Wheel. See Metal wheel. Traction wheel. Water wheel.
Wick, lamp, A. S. Yanez 388,609
Window dresser, G. F. Hall 388,776
Window shade bracket, T. Gorsuch 388,775
Wire rope or cable, H. W. Farley 388,656
Wire tightener, D. T. Brown 388,626
Wire working machines, reel stand and stop for, L. J. Crecellus 388,479
Wood rack and carrier, W. H. Moody 388,434
Wrench. See Chain wrench. Pipe wrench.
Wringer. See Mop wringer.
Yarn for filling, etc., preparing, R. C. Newell 388,436
Yoke ring, neck, R. K. Burt 388,758

DESIGNS.

Basket, W. Haley 18,566
Biscuit or cracker, D. H. Stauffer 18,580
Bottle, A. Kohn 18,572
Button, campaign, J. M. Jones 18,571
Button, campaign, R. Liebmann 18,574
Carpet, M. F. Beale 18,559
Carpet, E. Fisher ..... 18,563 to 18,565
Carpet, H. Horan ..... 18,567 to 18,569
Carpet, W. L. Jacobs 18,570
Carpet, E. Poole ..... 18,575 to 18,578
Checkrein hook, G. S. Cascaden 18,561
Corset, J. Koon 18,573
Fan, handkerchief, etc., D. Rhodes 18,579
Handkerchief, H. G. Worthington 18,582
Metal plate, T. & G. M. Stone 18,581
Type, font of, H. Brehmer 18,560
Walls, surface ornamentation of, L. Clemencet 18,562

TRADE MARKS.

Beer, fluid malt, extract of malt, and a malt preparation, lager, G. Manz Brewing Company 15,816
Beverage containing fruit properties, non-alcoholic, C. H. Sagar 15,820
Cement, mineral, Kaw Valley Cement Company 15,815
Cement, Portland, J. C. Gostling & Company 15,813
Cure for certain named diseases, P. J. Muilberger. 15,817
Gunpowder, ammunition, and explosives, C. W. Curtis 15,811
Medical remedies, certain named, F. Eberlein 15,812
Ointment or salve, S. R. Payne 15,819
Pulmonary sirup for human use, W. R. Ashurst 15,809
Shoes for men, heavy, Packard & Grover 15,818
Stove boards, embossed sheet metal, A. I. Griggs 15,814
Sulphate of quinine, sulphuric and salicylic acids, alcohol, and cochineal, compound of, T. Blank. 15,810
Wool, zephyr-finish Germantown, I. D. Allen & Co 15,808

A printed copy of the specification and drawing of any patent in the foregoing list will be furnished from this office for 25 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York.

Canadian Patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

SEBASTIAN, MAY & CO'S
Improved Screw Cutting
Foot & Power **LATHES** $60

Drill Presses, Chucks, Drills, Dogs, and machinists' and amateurs' outfits. *Lathes on trial.* Catalogues mailed on application.
165 W. 2d St., Cincinnati, O.

TOOLS Scroll Saws, Foot Lathes, Tools and Supplies for Amateurs and Machinists. Catalogue FREE.
Novelty Tool Co., 177 Elm St., Cincinnati, O.

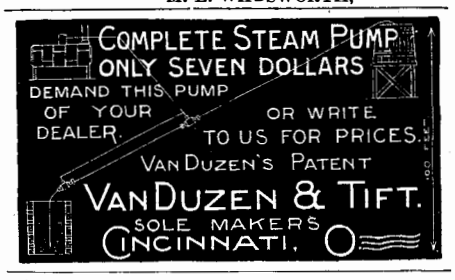
ELECTRIC WELDING.—A PAPER BY Prof. Elihu Thomson, giving an account of a new way of utilizing the heating effects of heavy electrical currents for causing union between pieces of metal, whether of the same or of different kinds. With 4 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **592.** Price 10 cents. To be had at this office and from all newsdealers.

ARTESIAN Wells, Oil and Gas Wells, drilled by contract to any depth, from 50 to 3000 feet. We also manufacture and furnish everything required to drill and complete same. Portable Horse Power and Mounted Steam Drilling Machines for 100 to 600 ft. Send 6 cents for illustrated catalogue.
Pierce Well Excavator Co. New York.

LIGHTNING CONDUCTORS.—DESCRIPTION of a new form of apparatus for testing lightning conductors, and the method of using it, illustrated with 8 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **596.** Price 10 cents. To be had at this office and from all newsdealers.

OIL WELL SUPPLY CO. Ltd.
91 & 92 WATER STREET,
Pittsburgh, Pa.,
Manufacturers of everything needed for
ARTESIAN WELLS
for either Gas, Oil, Water, or Mineral Tests, Boilers, Engines, Pipe, Cordage, Drilling Tools, etc. Illustrated catalogue, price lists and discount sheets on request.

THE MICHIGAN MINING SCHOOL, HOUGHTON, MICH.
This School offers a two years' practical course in Mining Engineering, Mineralogy, Petrography, General and Economic Geology, Chemistry, Assaying, Surveying, Mechanical Drawing, and related branches. In 1889 the course will be increased to three years for all students entering after 1888. The School, being centrally located in the Mineral Region of Lake Superior, affords special advantages for instruction in practical mining. The climate of the region is cool and healthful, and as the School is a State institution, the tuition is free. For catalogues and further information, address
M. E. WADSWORTH, Director.



GEOLOGY EXPLAINED IN ITS SIMPLEST FORM.—An interesting object lesson in geology. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **630.** Price 10 cents. To be had at this office and from all newsdealers.

GUILD & GARRISON
BROOKLYN, N. Y., U. S. A.
Builders of **Steam Pumps** for Water and every description of Liquids or Semi-liquids. **Vacuum Pumps** of the highest efficiency. **Filter Press Pumps, Air, Gas, and Acid Blowers. Air Compressors. Boiler Feed Pumps, etc.**

LEAD SMELTING.—A FULL DESCRIPTION of the Lewis Bartlett process, by William Ramsay; illustrated with 9 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **593.** Price 10 cents. To be had at this office and from all newsdealers.

SECTIONAL INSULATED AIR COVERINGS
FOR PIPES, BOILERS, DRUMS, AND ALL OTHER HOT & COLD SURFACES
SHIELDS & BROWN CO.
143 WORTH ST. NEW YORK.
240 & 242 RANDOLPH ST. CHICAGO.
ASBESTOS, CEMENT, PACKING, SHEATHING &C.

CHEMICAL AND ALLIED INDUSTRIES.—By Watson Smith. An elaborate report upon the objects illustrative of the progress, advance, and present position of the chemical industries shown at the Manchester Royal Jubilee Exhibition. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **627, 628, 629, 630, 632.** Price 10 cents each or 50 cents for the series. To be had at this office and from all newsdealers.

OIL ENGINES. For Printers, Steam Yachts, pumping water, sawing wood, making ice-cream, Carpenters, Mechanics. 1 to 8 H. P. Fuel, Kerosene. **No dust.** Automatic in fuel and water supply. Illustrated Catalogue free. See illustrated notice in Sci. Am. Aug. 4, 1888.
SHIPMAN ENGINE CO.
92 Pearl St., Boston, Mass.

Scientific Book Catalogue
RECENTLY PUBLISHED.
Our new catalogue containing over 100 pages, including works on more than fifty different subjects. Will be mailed free to any address on application.
MUNN & CO., Publishers Scientific American,
361 Broadway, New York.

No Loose Bristles! No Bleeding Gums!
Perfectly Polished Teeth!

Absorbs Deposits, Polishes Enamel, Soothes Gums, Prevents Decay, } which { Bristles Leave Behind. Bristles Destroy. Bristles Torture. Bristles Excite.
ITS ECONOMY. Holder (imperishable), **35** cents. Polishers only need be renewed. 18 (boxed) **25** cents. Dealers or mailed.
HORSEY MFG. CO., Utica, N. Y.

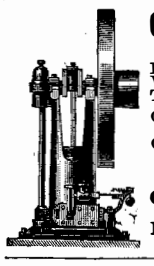
TELESCOPES—THEIR HISTORY and the discoveries made with them.—By Prof. E. S. Holden. An interesting historical paper, discussing the development of the telescope from the time of Galileo up to the present day. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **629.** Price 10 cents. To be had at this office and from all newsdealers.

TELESCOPIC OBJECTIVES AND MIRRORS. Their preparation and testing.—By H. Grubb, F. R. S. An interesting description of the processes now employed in the construction of telescopic objectives, prefaced with a short history of the manufacture of glass. Contained in SCIENTIFIC AMERICAN SUPPLEMENTS, Nos. **548** and **549.** Price, 10 cents each. To be obtained at this office or from any newsdealer.

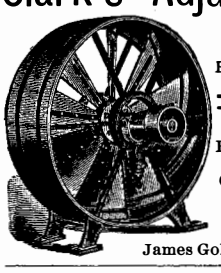
DELAFIELD'S PAT. SAW CLAMP

With saw for cutting metals. Saves all the broken hack-saw blades. In use over two years in all parts of the country. The new clamps have the edges bevelled that hold the saw. By mail, with one blade, 50 cents. Extra blades 8½" x ¾", "Star," 7 cents each, 70 cents per dozen, by mail. Blades 8" x 1", "Stubs," 35 cents each, by mail. Discount to dealers.
NOROTON MFG. WORKS, Noroton, Conn.

CITY OF LONDON AND SOUTHWARK SUBWAY.—Description of a new underground railway now in course of construction in London. With 7 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **626.** Price 10 cents each. To be had at this office and from all newsdealers.


OTTO GAS ENGINES.
Over 25,000 Sold.
Horizontal ..... Otto .. Gas Engines.
Vertical ..... Otto .... Gas Engines.
Twin Cylinder .. Otto .... Gas Engines.
Combined ..... Otto .. { Gas Engines and Pumps.
Combined ..... Otto .. { Gas Engines and Dynamos
OTTO GAS ENGINE WORKS,
CHICAGO, PHILADELPHIA.
New York Agency, 18 Vesey Street.

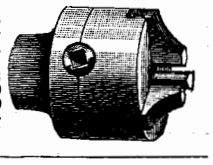
PHTHISIS.—A PAPER BY DR. H. C. Wood, describing in detail the new treatment of consumption by sulphureted hydrogen. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **594.** Price 10 cents. To be had at this office and from all newsdealers.

Clark's Adjustable Wing Ventilating Fans,

For Ventilation of every description.
Heavy Fans FOR DRYERS.
Results Guaranteed.
Catalogue Free.
GEO. P. CLARK,
Box L,
Windsor Locks, Conn.
New York Agent,
James Goldsmith, 744 Broadway, N. Y.

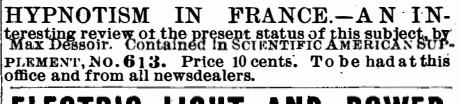
ELECTRICAL STRESS.—AN INTERESTING paper by Prof. A. W. Rucker, on the stresses that exist in a dielectric between conductors of different potentials. With 9 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **646.** Price 10 cents. To be had at this office and from all newsdealers.

THE CUSHMAN KEY DRILL CHUCK.
This is an improvement over all other chucks of its class and is fully guaranteed.

	DIAM.	HOLDS	PRICE
No. 1,	2 in.	0 to ½ in.	$6.50
No. 2,	2½ in.	1-64 to ⅝ in.	8.00


Sold by the trade and Manufactured by THE CUSHMAN CHUCK CO., Hartford, Conn.

SHIP WAVES.—BY SIR WILLIAM Thomson. A lecture delivered before the Institution of Mechanical Engineers.—Definition of wave. The different kinds of waves. Waves produced in water by boats and the wind. How the wave procession is kept up. Effect of a ship's build in causing waves: With eight figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **615.** Price ten cents. To be had at this office and from all newsdealers.



HYPNOTISM IN FRANCE.—AN INTERESTING review of the present status of this subject, by Max Dessoir. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **613.** Price 10 cents. To be had at this office and from all newsdealers.

ELECTRIC LIGHT AND POWER.
Edco system of Arc and Incandescent Lighting. Direct or in connection with the Storage Batteries of the Electrical Accumulator Co. Dynamos, Motors, Lamps, Batteries, and General Electrical Supplies.
THE ELECTRO DYNAMIC COMPANY,
224 Carter Street, Philadelphia, Pa.

© 1888 SCIENTIFIC AMERICAN, INC.

HENRY CAREY BAIRD & CO.
Industrial Publishers, Booksellers, and Importers,
810 Walnut St., Philadelphia, Pa., U. S. A.
☞ Our new and Revised Catalogue of Practical and Scientific Books, 80 pages, 8vo, and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.

ARCHITECTURAL BOOKS.
Useful, Beautiful, and Cheap.

To any person about to erect a dwelling house or stable, either in the country or city, or any builder wishing to examine the latest and best plans for a church, school house, club house, or any other public building of high or low cost, should procure a complete set of the ARCHITECTS' AND BUILDERS' EDITION of the SCIENTIFIC AMERICAN.

The information these volumes contain renders the work almost indispensable to the architect and builder, and to persons about to build for themselves they will find the work suggestive and most useful. They contain colored plates of the elevation, plan, and detail drawings of almost every class of building, with specification and approximate cost.

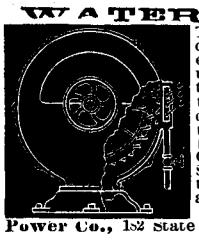
Four bound volumes are now ready and may be obtained, by mail, direct from the publishers or from any newsdealer. Price, $2.00 a volume. Stitched in paper covers. Subscription price, per annum, $2.50. Address and remit to

MUNN & CO., Publishers,
361 Broadway, New York.

THE FORTH BRIDGE.—A PAPER BY A. S. Biggart, describing the method employed in the erection of this great engineering work. With 8 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **626.** Price 10 cents. To be had at this office and from all newsdealers.

WATCHMAKERS Send for REDUCED PRICE LIST of Whitcomb Lathes, date of July 1, 1888. American Watch Tool Co., Waltham, Mass.

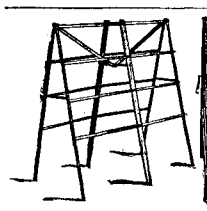
THE MIND CURE.—BY MARY J. FINley, M.D. A review of the theory of metaphysical healing in its relation to physiology and pathology. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **627.** Price 10 cents. To be had at this office and from all newsdealers.

WATER MOTORS.

The most efficient and economical means of obtaining from one-eighth to fifteen horse power and upward. A motor which does the greatest amount of work with the use of the smallest stream of water, specially adapted for running cheaply and efficiently, Printing Presses, Elevators, Church Organs, Coffee Mills, Sewing Machines, Lathes, Dental Contrivances, and in fact, any piece of Mechanism.
Binghamton Hydraulic Power Co., 152 State Street, **Binghamton, N. Y.**

THE PENNA. DIAMOND DRILL & MFG. CO. BIRDSBORO, PA., Builders of High Class Steam Engines, Diamond Drilling and General Machinery. Flour Mill Rolls Ground and Grooved.

Makes a perfect Pipe Wrench of any screw wrench. Send for circular. Agents wanted. H. W. ATWATER, 38 Warren Street, N. Y. City.
75 cents, by mail.

BIT Square, Oval, or Round Smooth Holes. For carpenter, cabinet, and pattern work, ½ in. 50c., set $4.00, mailed free. Bridgeport Gun Implement Co., 17 Maiden Lane, N. Y.


THE BURGESS
Folding Clothes Frame
Patented Jan. 17, 1888. Every convenience possible for a clothes frame, it far surpasses anything of the kind.
Business men and manufacturers wanting State and county rights, apply to
S. F. BURGESS,
West Morris, Conn.

COMPARATIVE VALUE OF STEAM and hot water for transmitting heat and power.—An elaborate discussion of the subject, by Charles E. Emory. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **615.** Price ten cents. To be had at this office and from all newsdealers.

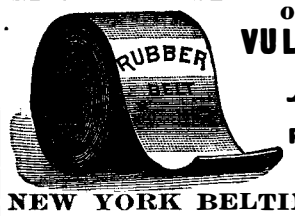
A NEW CATALOGUE OF VALUABLE PAPERS
Contained in SCIENTIFIC AMERICAN SUPPLEMENT, sent *free of charge* to any address.
MUNN & CO., 361 Broadway, New York.

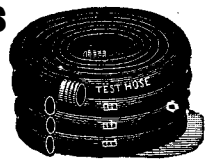
MODEL and EXPERIMENTAL WORK A SPECIALTY. Send for Circulars. **C. E. Jones & Bro.** CINCINNATI, O. (Mention this Paper.)

PERFECT NEWSPAPER FILE
The Koch Patent File, for preserving newspapers, Magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of $1.50 by mail, or $1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN" in gilt. Necessary for every one who wishes to preserve the paper. Address
MUNN & CO., Publishers SCIENTIFIC AMERICAN.

CURE FOR THE DEAF

PECK'S PATENT IMPROVED CUSHIONED EAR DRUMS **Perfectly Restore the Hearing,** whether deafness is caused by colds, fevers or injuries to the natural drums. Invisible, comfortable, always in position. Music, conversation, whispers heard distinctly. Write to F. HISCOX, **853** Broadway, cor. 14th St. New York, for illustrated book of proofs FREE.

RUBBER BELTING, PACKING, HOSE.
Oldest and Largest Manufacturers in the United States.


VULCANIZED RUBBER FABRICS
For Mechanical Purposes.
Air Brake Hose
A SPECIALTY.
RUBBER MATS, RUBBER MATTING, AND STAIR TREADS.


NEW YORK BELTING & PACKING CO., 15 PARK ROW, N. Y.
JOHN H. CHEEVER, Treas., J. D. CHEEVER, Dep'y Treas. Branches: 167 Lake St., Chicago; 308 Chestnut St., Phila.; 52 Summer St., Boston; Post & Co., Cin., O. Europe'n Br'ch, Pickhuben 5 Hamburg (Freihafengebiet), Ger.

Shepard's New $60 Screw-Cutting Foot Lathe

Gap Lathe, $125.
Foot and Power Lathes, Drill Presses, Scroll Saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, etc.
Lathes on trial. Lathes on payment.
Send for catalogue of Outfits for Amateurs or Artisans.
Address **H. L. SHEPARD, AGENT, 134 East 2d Street, Cincinnati, Ohio.**

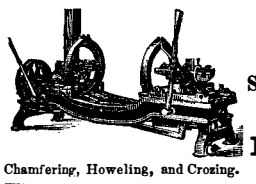
IRRIGATING MACHINERY ON THE Pacific Coast.—By John Richards. An elaborate discussion of the modifications that have had to be made in irrigating machinery to meet the requirements of local conditions in California. Contained in SCIENTIFIC AMERICAN SUPPLEMENT Nos. **624** and **625.** Price 10 cents each. To be had at this office and from all newsdealers.

DUPLEX GAS REGULATOR CO. City, county, and state rights for sale. On exhibition at **105 West 41st Street, New York.**

HOW TO MAKE THE WIMSHURST Influence Machine.—Directions for making a cheap and simple but efficient machine. With one figure. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **646.** Price 10 cents. To be had at this office and from all newsdealers.

$10.00 to $50.00 per night. A light and profitable business. **Magic Lanterns and Views** of popular subjects. Catalogues on application. Part 1 Optical. 2 Mathematical, 3 Meteorological, 4 Magic Lanterns, etc. **L. MANASSE, 88 Madison Street, Chicago, Ill.**

PROPULSION OF STREET CARS.—A paper by A. W. Wright, in which an endeavor is made to solve the problem as to the amount of power required to start a street car and keep it in motion under average conditions. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **533.** Price 10 cents. To be had at this office and from all newsdealers.


BARREL, KEG, Hogshead, AND STAVE MACHINERY.
Over 50 varieties manufactured by
Chamfering, Howeling, and Crozing. **E. & B. HOLMES, BUFFALO, N. Y.**

PENSIONS $80,000,000 for Soldiers, Sailors, their widows or parents. PENSIONS INCREASED. Discharges procured. ☞ No pension, NO FEE. Latest law, pamphlet Free! PATRICK O'FARRELL, Att'y, Washington, D. C.

HUDSON RIVER BRIDGE AT Poughkeepsie.—A lecture by T. C. Clarke, C. E., in the Sibley College Course. General description, Foundations, Superstructure, Temporary Staging, Trestle Work With 3 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **646.** Price 10 cents. To be had at this office and from all newsdealers.

VOLNEY W. MASON & CO.,
FRICTION PULLEYS CLUTCHES and ELEVATORS
PROVIDENCE, R. I.

TALCOTT'S COMBINATION PATENT BELT HOOKS,
W. O. TALCOTT, Providence, R. I.

NATURAL GAS INDUSTRY AT PITTSburg, Pa.—A brief history of the Chartiers Valley Gas Company. With 5 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **627.** Price 10 cents. To be had at this office and from all newsdealers.

HARRISON CONVEYOR!
For Handling Grain, Coal, Sand, Clay, Tan Bark, Cinders, Ores, Seeds, &c.
Send for Circulars. **BORDEN, SELLECK & CO.,** {Sole Manu'fers,} **Chicago, Ill.**

The **TRENTON ENGINE** AUTOMATIC CUT-OFF BALANCE VALVE Highest duty, economy, and durability guaranteed. **Phenix Iron Co. Trenton, N. J.,** M'f'rs. F. VAN WINKLE, Agt., 91 Liberty St., N. Y.

Mary J. Holmes' New Story **"MILDRED'S AMBITION"** A story of social ambition, by the most popular story writer in America. Every mother should read it and place it in the hands of her daughters. A pure, domestic story—not at all sensational, but intensely interesting.

Rose Terry Cooke's New Story **"THE WISDOM OF THE ANCIENTS"** A story of dress and redress.

"LUMAN SKINKLE'S RELIGION" BY **Josiah Allen's Wife**
The best story she has ever written. Its rich, keen sarcasm is irresistible. She keeps the reader convulsed with her sharp hits—spiced with pure fun, strong common sense and sound moral lessons.

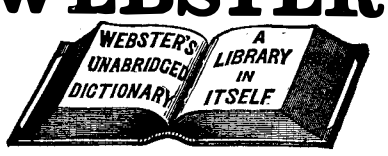
Will Carleton's POEMS—with full-page drawings, finest illustrations ever engraved, by best artists.
"THE GRAND OLD DAY" a Thanksgiving poem.
"THE VOICE OF A STAR" a Christmas poem.

HOW WOMEN CAN MAKE MONEY
SKETCHES AND PORTRAITS OF Distinguished Women.
LADIES' Home Journal
AND
PRACTICAL HOUSEKEEPER
YOU shall have it FROM NOW to JANUARY 1889
Four months, beginning September, for only
10 CENTS
Silver or Stamps
the mere cost of paper, postage, &c.
We want to put it in A MILLION families on trial.
CURTIS PUB. CO.
Philadelphia. Pa.

ICE & REFRIGERATING Machines. York Patent. **YORK MFG CO., York, Pa.**

Mayor's Office, City Hall,
BROOKLYN, N. Y., *August* 23, 1888.
Notice is hereby given that the time for the reception of designs for the Soldiers' and Sailors' Monument has been extended to October 10, 1888. Competitors must comply with the conditions of the competition on file in the office of the Mayor.
ALFRED C. CHAPIN, *Mayor.*
THOMAS B. RUTAN, *Chairman Memorial Committee.*
JOHN MCCARTY, *President Board of Aldermen.*

Coil-Boilers for the United States Navy.—NAVY DEPARTMENT, WASHINGTON, D. C., *August* 2, 1888.—The Navy Department, having in view the possible decrease in weight of machinery in vessels of war by the use of tubulous, sectional, or coil-boilers, has determined to adopt such boilers, if suitable can be found, for a portion of the steam-power of one or more of the vessels about to be built. To this end, manufacturers who wish to offer such boilers for use by the Department are hereby invited to furnish plans of the same, adapted to an armored coast-defense vessel, on or before September 15, 1888. Plans must be accompanied by certificates that boilers of the same make are or have been in successful use at sea or on shore. Plans showing the space in the vessel available for boilers, particulars of the duty required, and other information, may be obtained upon application to the Bureau of Steam Engineering. The boiler which appears to the Department, after investigation, to be the best for the purpose, taking into account the evaporative efficiency, the dryness of the steam, the weight of the boiler, the weight of the water contained, the accessibility for repairs, the ease of making repairs, the simplicity and interchangeability of the parts, the space occupied, the ease of firing and of regulating the feed, the suitability for working in battery, the capability of long-continued steaming without cleaning, and the durability, will be adopted in the coast-defense vessel above mentioned, provided that the price, which must be stated when the plans are submitted, is satisfactory to the Navy Department. Such boilers as appear to possess merit will be tested by the Navy Department, if the manufacturers so desire, to determine which is the more suitable for the purpose. Manufacturers who wish their boilers to be tested must furnish a boiler of the type of one of those proposed for the vessel and prepare it for test, either at their own works or at such place as may be arranged with the Department. The expense of the test of the accepted boiler will be borne by the Navy Department, and the cost of the fuel used in the test of the second best will also be borne by the Navy Department. All other tests must be at the expense of the parties offering boilers for competition,
WILLIAM C. WHITNEY, *Secretary of the Navy.*

WEBSTER


3000 more Words and nearly **2000** more Illustrations than any other American Dictionary.
Among the supplementary features, unequaled for concise and trustworthy information, are
A Biographical Dictionary
giving brief facts concerning 9,700 Noted Persons of ancient and modern times,
A Gazetteer of the World
locating and describing 25,000 Places; and a Vocabulary of the names of Noted
Fictitious Persons and Places.
The latter is not found in any other Dictionary.
Webster excels in **SYNONYMS** which are appropriately found in the body of the work.
Sold by all Booksellers. Pamphlet free.
G. & C. MERRIAM & CO., Pub'rs, Springfield, Mass

QUARANTINE SYSTEM OF LOUISIana.—By Joseph Holt, M.D. Description of the methods of disinfection practiced. With 4 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **627.** Price 10 cents. To be had at this office and from all newsdealers.

WELL TOOLS Encyclopedia of 700 Engravings of WELL TOOLS. **ELL** Diamond Drills and Lightning Hydraulic WELL Machines. **LL** Book free, 25c. for mailing it. American Well Works, Aurora, Ill.

2nd MACHINERY Lists Sent. N. Y. Mach'y Depot, Bridge Store 16, Frankfort St., N.Y.

SAWS How to **Straighten** and **Gum** all kinds. Address, A. E. WILBUR, Oneonta, N. Y.

THE ECLIPSE Copying Apparatus
One thousand copies in black. No special paper, no stencil, no special pen required. The natural handwriting is so exceeding faithfully reproduced that in most cases "Eclipse" Circulars have been taken for ordinary written letters. Circular and specimen on application.
FELIX F. DAUS & CO.,
698 Broadway, New York.

TAKE THE MONON ROUTE BETWEEN Chicago and Indianapolis, Cin. winter cities the Louisville, Cincinnati, and all of Florida and South.
LOUISVILLE, NEW ALBANY & CHICAGO RY.
E. O. McCormick, Gen. Pass. Agent, Chicago.

TELESCOPE For Sale. Ten inch silver glass equatorial mount. F. M. B., 257 S. Market, Springfield, O.

A VALUABLE PATENT FOR SALE.—Improved Umbrella, No. 376,693, dated January 17, 1888. This invention is novel, simple, durable, and cheap; the bearings and frame are made for everlasting use. Manufactured at one-half cost of original. It will enable purchaser to corner other competitors and rule the market. Price of patent, $5,000; a golden chance for investment. State, county, and shop rights. Agents wanted to canvass with samples. Address patentee,
J. C. Warren, M.D., Menallen, Adams Co., Penn.

WIRE WEAVING.—Particulars and prices of the new American looms for light wire weaving by power required by D. Allport, 7 St. Benet Place, London, Eng.

Two Valuable Patents for sale cheap, by patentee. Are in great demand. Have no opposition. Easily manufactured. Address MANNES, 920 27th St., Denver, Col.

The Scientific American
PUBLICATIONS FOR 1888.

The prices of the different publications in the United States, Canada, and Mexico are as follows:

RATES BY MAIL.

The Scientific American (weekly), one year	$3.00
The Scientific American Supplement (weekly), one year	5.00
The Scientific American, Export Edition (monthly) one year	5.00
The Scientific American, Architects and Builders Edition (monthly), one year	2.50

COMBINED RATES.

The Scientific American and Supplement	$7.00
The Scientific American and Architects and Builders Edition	5.00
The Scientific American, Supplement, and Architects and Builders Edition	9.00

Proportionate Rates for Six Months.

This includes postage, which we pay. Remit by posta or express money order, or draft to order of
MUNN & CO., 361 Broadway, New York.

© 1888 SCIENTIFIC AMERICAN, INC.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

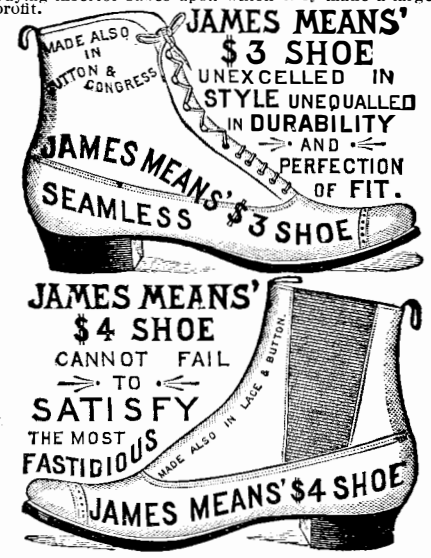
The March of Progress!

OUR LATEST IMPROVEMENT!

"Competition is the life of trade," and if you have not seen our improved **$3** Shoe, made for the **Summer and Fall trade of 1888,** you cannot imagine how lively trade is, or how hard our competitors have to work to keep within sight of us.

Ask your retailer for the James Means' **$3** Shoe, or the James Means' **$4** Shoe, according to your needs.

Positively none genuine unless having our name and price stamped plainly on the soles. Your retailer will supply you with shoes so stamped if you insist upon his doing so; if you do not insist, some retailers will coax you into buying inferior shoes upon which they make a larger profit.


MADE ALSO IN BUTTON & CONGRESS
JAMES MEANS' $3 SHOE
UNEXCELLED IN STYLE UNEQUALLED IN DURABILITY AND PERFECTION OF FIT.
JAMES MEANS' $3 SHOE
SEAMLESS
JAMES MEANS' $4 SHOE
CANNOT FAIL TO SATISFY THE MOST FASTIDIOUS
MADE ALSO IN LACE & BUTTON.
JAMES MEANS' $4 SHOE

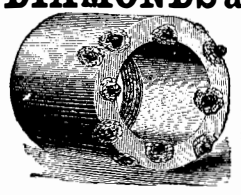
Such has been the recent progress in our branch of industry that we are now able to affirm that the James Means' **$4** Shoe is in every respect equal to the shoes which only a few years ago were retailed at eight or ten dollars. If you will try on a pair, you will be convinced that we do not exaggerate.

Ours are the original **$3** and **$4** Shoes, and those who imitate our system of business are unable to compete with us in quality of factory products. In our lines we are the largest manufacturers in the United States.

Shoes from our celebrated factory are sold by wide-awake retailers in all parts of the country. We will place them easily within your reach in any State or Territory if you will invest one cent in a postal card and write to us, mentioning the SCIENTIFIC AMERICAN.

James Means & Co., 41 Lincoln St., Boston, Mass.

DIAMONDS and CARBON



For Prospecting Mining Drills, also for all kinds of Mechanical Purposes.

The subscriber is the **Pioneer** in this business, and is the Oldest Established House in the States. He only deals in first-class articles. Send for circular to

J. DICKINSON,
64 Nassau St., N. Y.

THE COPYING PAD.—HOW TO MAKE and how to use; with an engraving. Practical directions how to prepare the gelatine pad, and also the aniline ink by which the copies are made; how to apply the written letter to the pad; how to take off copies of the letter. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **438.** Price 10 cents. For sale at this office and by all newsdealers in all parts of the country.

MALLEABLE AND FINE GRAY IRON ALSO STEEL CASTINGS FROM SPECIAL PATTERNS FINE TINNING JAPANNING AND FINISHING
T. THOMAS DEVLIN & CO. LEHIGH AVE. & AMERICAN ST. PHILA.

ALCOHOL. SWEET POTATO. — AN account of a new industry recently established at the Azores—that of the distillation of alcohol from raw sweet potatoes. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **572.** Price 10 cents. To be had at this office and from all newsdealers.

PHOTOGRAPHIC OUTFITS *for Amateurs, Field Glasses, Microscopes, Telescopes, Spectacles, Barometers, Lantern Slides.* **W. H. WALMSLEY & CO.** Philada., Pa. Illus. price list free. Send for *Special Bargain Lists.*

GOLD MINING MACHINERY. — DESCRIPTION of some new mining plants constructed in England for use in the Transvaal, Austria and Hungary. With 10 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **593.** Price 10 cents. To be had at this office and from all newsdealers.

Barnes' Foot-Power Machinery.
Complete outfits for Actual Worksnop Business. Read what a customer says: "Considering its capacity and the accurateness of your No. 4 Lathe, I do not see how it can be produced at such low cost. The velocipede foot-power is simply elegant. I can turn steadily for a whole day and at night feel as little tired as if I had been walking around." Descriptive Catalogue and Price List Free. W. F. & JOHN BARNES Co. Address 1999 Main St., Rockford, Ill.

PATENTS.

MESSRS. MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had *forty-one years experience*, and now have *unequaled facilities* for the preparation of Patent Drawings, Specifications, and the prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs Munn & Co. also attend to the preparation of Caveats, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very reasonable terms.

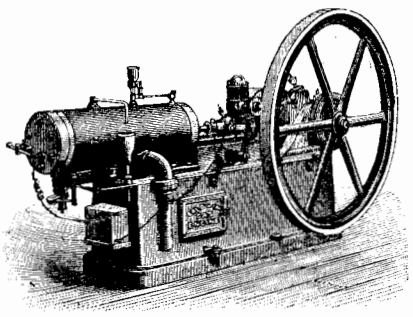
A pamphlet sent free of charge, on application, containing full information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world.

MUNN & CO., Solicitors of Patents,
361 Broadway, New York.

BRANCH OFFICES.—No. 622 and 624 F Street, Pacific Building, near 7th Street, Washington, D. C.

NEW GAS ENGINE



"The Baldwin"

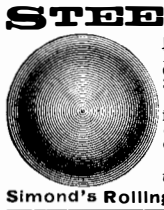
Exhibited at the late American Institute Fair, New York.

A four horse-power engine in connection with storage battery, running 84 incandescent electric lights (and without battery, 32 lights), giving a perfect light, with all the steadiness that can be obtained from the high-speed steam engines in common use for electric lighting, and permitting any number of lights to be shut off or turned on without affecting the remaining lights in the slightest degree. A marvel of beauty, perfection, and power, adapted to lighting, pumping, and all purposes where a safe and cheap power is required. Manufactured and guaranteed by

Otis Brothers & CO.
Elevators and Hoisting Machinery,
38 PARK ROW, NEW YORK.

THE AGE OF THE STARS. — BY Prof. Janssen. History of the discoveries that have led to the introduction of the doctrine of evolution in the science of astronomy. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **630** and **631.** Price 10 cents each. To be had at this office and from all newsdealers.

STEEL BALLS.



For Anti-Friction Bearings, of Best Cast Steel. Hardened, Ground, and Burnished, from 3-16 in. to 2 in. diameter.

In quality and density of metal, in uniformity of temper, and in accuracy and nicety of finish warranted unequaled.

☞ *Samples and prices on application.*

Simond's Rolling-Machine Co., Fitchburg, Mass.

HOME-MADE INCUBATOR.—PRACTICAL directions for the manufacture of an effective incubator that has been carefully tested and found to perform all that may be reasonably expected; with directions for operating. With 4 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **630.** Price 10 cents. To be had at this office and from all newsdealers.

PRESERVATION OF MEAT Without Cans—Egg shell method. Apply to DR. SALZER, 613 Park Ave., Baltimore, Md.

TO INVENTORS AND MANUFACTURERS

The 57th Annual Exhibition

—OF THE—

American Institute of the City of New York
Will Open OCTOBER 3, 1888.

Intending Exhibitors must make early application to secure proper space and classification. For blanks and information, address **General Superintendent,**
American Institute, New York City.

THE MODERN ICE YACHT. — BY Geo. W. Polk. A new and valuable paper, containing full practical directions and specifications for the construction of the fastest and best kinds of Ice Yachts of the latest, most approved forms. Illustrated with engravings drawn to scale, showing the form, position, and arrangement of all the parts. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **624.** Price 10 cents. To be had at this office and of all newsdealers.

CALL FOR AND INSIST ON HAVING JENKINS BROS.' VALVES. IF YOU WANT THE MOST DURABLE & RELIABLE
71 JOHN ST., NEW YORK.
21 North 5th ST. PHILA.
105 Milk ST. BOSTON.
54 DEARBORN ST. CHICAGO.

THE PHONOGRAPH.—A DETAILED description of the new and improved form of the phonograph just brought out by Edison. With 8 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **632.** Price 10 cents. To be had at this office and from all newsdealers.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.
HARTFORD. CONN.

DREDGER CAUTION

Parties whom I have sued and others infringing my patents *are seeking to sell their machines or subordinate patents before judgment can be had.* I purpose availing myself of **all the protection afforded by law** and **warn all** to look carefully before buying. I hold nine dredger patents and have applications for numerous improvements pending.

A. B. Bowers, 1110 8th St. N. W., Washington, D. C.

SEAMLESS BRASS & COPPER TUBES, SHEET BRASS, BRASS WIRE. CHARLES J. JESSOP'S FINE TOOLS TAPS DRILL CHUCKS. 175-177 LAKE ST. CHICAGO. SEND FOR CATALOGUE.

Mention this paper.

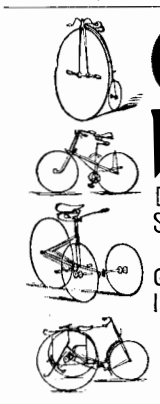
ASBESTOS

PIPE COVERINGS

Made entirely of ASBESTOS.
Absolutely Fire Proof.

BRAIDED PACKING, MILL BOARD, SHEATHING, CEMENT, FIBRE AND SPECIALTIES.
CHALMERS-SPENCE CO., FOOT E. 8TH ST., N. Y.
BRANCHES: Phila, 24 Strawberry St. Chicago, 86 E. Lake St. Pittsburg, 37 Lewis Block.

FOR SALE. Patent for a Simple and Compact Knife Cleaning Machine. See illustrated notice in SCIENTIFIC AMERICAN of September 1, 1888. For particulars, address ROBERT W. JAMIESON, Prince Albert, Saskatchewan, N.W. T., Can.



COLUMBIA BICYCLES · TRICYCLES TANDEMS

DURABLE · SIMPLE

GUARANTEED=HIGHEST GRADE ILLUSTRATED CATALOGUE=FREE

POPE MFG. CO.
79 FRANKLIN ST. BOSTON
BRANCH HOUSES 12 WARREN ST. NEW YORK, 291 WABASH AVE. CHICAGO.

MACHINISTS' SUPPLIES SEND 13 CENTS FOR ILLUSTRATED CATALOGUE MONTGOMERY & CO 105 FULTON ST. N.Y. LATHES CHUCKS TOOLS DRILLS SCREWS CALLIPERS ETC.

JAMES B. EADS.—AN ACCOUNT OF the life and labors of this eminent engineer. With a portrait. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **592.** Price 10 cents. To be had at this office and from all newsdealers.

AMATEUR PHOTOGRAPHY.

The most fascinating **AMUSEMENT** for home or outdoor recreation.

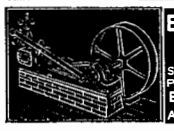
Anybody **can do it** by simply following directions as given in **The Amateur Photographer,** a complete guide to photography, which accompanies each Camera, and is conceded to be the simplest, most concise and practical work published

Complete Outfits, $10.00 and upward.
ROCHESTER OPTICAL COMPANY,
21 Aqueduct Street, Rochester, N. Y.

PATENT JACKET KETTLES,

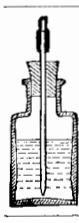
Plain or Porcelain Lined. Tested to 100 lb. pressure. Send for Lists.
HAND, BURR & CO.,
614 and 616 Market St., Philadelphia, Pa.

HOW TO MAKE AN INCUBATOR.—Full directions, illustrated with 7 figures. Also directions for operating the apparatus. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **612.** Price 10 cents. To be had at this office and from all newsdealers.



ERIE ENGINE WORKS
CLEVELAND & HARDWICK,
WALNUT STREET, ERIE, PA.
STATIONARY, PORTABLE, SEMI-PORTABLE, COMBINED, AGRICULTURAL ENGINES, STATIONARY, PORTABLE, VERTICAL BOILERS.

ELECTRIC CONVEYORS.—DESCRIPTION of two ingenious systems for the electric carriage of small packages. Illustrated with 13 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **464.** Price 10 cents. To be had at this office and from all newsdealers.



KEUFFEL & ESSER, New York,

INDELIBLE DRAWING INKS.

Black, Brown, Blue, Green, Scarlet, Carmine, Yellow.

The best ever produced. Have our Patent Ink Filler, which regulates supply to pen; prevents soiling outside of pen-blades; is the only cleanly device for filling pens. Sample assortment, seven vials (of above colors), mailed on receipt of **50** cents.

FIRE-BRICK.—BY R. A. COOK, A.M. An interesting description of the mining of fire clay and the manufacture of fire brick at Mt. Savage, Maryland where is located one of the largest establishments in the country devoted to this industry. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **538.** Price 10 cents. To be had at this office and from all newsdealers.

25% TO 50% SAVING IN GAS BILLS TO MANUFACTURERS
By adopting "Chamberlain's Gas Controller Burner."
Am. Gas Controller and Fixture Co., SPRINGFIELD, MASS.
Branches: 733 B'way, New York; C. D. LEET, U. S. Hotel, Boston.

CHALLENGE EMERY GRINDING AND POLISHING MACHINERY
DIEBEL MF'G. CO. THIRD AND CUMBERLAND. PHILA.

NAVAL ARCHITECTURE.—AN INteresting review, by Mr. R. Duncan, of the progress that has been made in this branch of science during the last fifty years. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **589.** Price 10 cents. To be had at this office and from all newsdealers.

SYRACUSE MALLEABLE IRON WORKS
W. B. BURNS PROP'R

THE AMERICAN BELL TELEPHONE CO.

95 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30th, 1877, No. 186,787.

The transmission of Speech by all known forms of Electric Speaking Telephones infringes the right secured to this Company by the above patents, and renders each individual user of telephones not furnished by it or its licensees responsible for such unlawful use, and all the consequences thereof, and liable to suit therefor.

AUTOMATIC CUT OFF ENGINES. PERFECTLY GOVERNED MANUFACTURED UPON SCIENTIFIC AND PRACTICAL PRINCIPLES
BALL ENGINE CO. ERIE PA.

THE Scientific American

ESTABLISHED 1846.

The Most Popular Scientific Paper in the World.

Only $3.00 a Year, including Postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc. Complete List of Patents each week.

Terms of Subscription.—One copy of the SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of **three dollars** by the publishers; six months, $1.50; three months, $1.00.

Clubs.—Special rates for several names, and to Post Masters. Write for particulars.

The safest way to remit is by Postal Order, Draft, or Express Money Order. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
361 Broadway, New York.

THE Scientific American Supplement.

This is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages full of engravings, many of which are taken from foreign papers, and accompanied with translated descriptions. THE SCIENTIFIC AMERICAN SUPPLEMENT is published weekly, and includes a very wide range of contents. It presents the most recent papers by eminent writers in all the principal departments of Science and the Useful Arts, embracing Biology, Geology, Mineralogy, Natural History, Geography, Archæology, Astronomy, Chemistry, Electricity, Light, Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information obtainable in no other publication.

The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are illustrated and described in the SUPPLEMENT.

Price for the SUPPLEMENT for the United States and Canada, $5.00 a year, or one copy of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT, both mailed for one year for $7.00. Single copies 10 cents. Address and remit by postal order, express money order, or check,

MUNN & Co., 361 Broadway, N. Y.,
Publishers SCIENTIFIC AMERICAN.

Builders Edition.

THE SCIENTIFIC AMERICAN ARCHITECTS' AND BUILDERS' EDITION is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming a large and splendid **Magazine of Architecture,** richly adorned with *elegant plates in colors*, and with other fine engravings; illustrating the most interesting examples of modern Architectural Construction and allied subjects.

A special feature is the presentation in each number of a variety of the latest and best plans for private residences, city and country, including those of very moderate cost as well as the more expensive. Drawings in perspective and in color are given, together with full Plans, Specifications, Sheets of Details, Estimates, etc.

The elegance and cheapness of this magnificent work have won for it the **Largest Circulation** of any Architectural publication in the world. Sold by al newsdealers. $2.50 a year. Remit to

MUNN & CO., Publishers,
361 Broadway, New York.

PRINTING INKS.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Phila., and 47 Rose St., opp, Duane St., N. Y.

© 1888 SCIENTIFIC AMERICAN, INC.